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February 1996

Final Environmental Impact Statement

Round Mountain Mill and Tailings Facility

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BUREAU OF LAND MANAGEMENT
Nevada State Office
850 Harvard Way
P.O. Box 12000
Reno, Nevada 89520-0006

In Reply Refer To:
N65-87-003P
1793/3809
(NV-060/065)
(NV-932.8)

JAN 29 1996

Dear Reader:

Enclosed for your information is the Final Environmental Impact Statement for the Smoky Valley Common Operation's Round Mountain Mill and Tailings Facility prepared by the Bureau of Land Management (BLM), Battle Mountain District Office. This Final Environmental Impact Statement analyzes the direct, indirect, and cumulative impacts associated with continued mining and construction of the proposed mill, tailings facility, and ancillary facilities. Three project alternatives (including the no action alternative) are analyzed, as well as the potential environmental impacts associated with pit dewatering, pit water quality, and the leach offload piles.

The Final Environmental Impact Statement contains in its entirety the analyses originally published in the Draft Environmental Impact Statement as well as responses to public comments received during the public review period. The comments received include 15 letters and two public meeting transcripts, which are reproduced in this Final Environmental Impact Statement. These comments have been responded to by clarifying or updating the analyses, making factual revisions, or explaining why a comment does not warrant further agency response.

Following the 30-day availability period of this Final Environmental Impact Statement, a Record of Decision will be issued. Questions or comments should be directed to: Christopher Stubbs, EIS Project Manager, Bureau of Land Management, Battle Mountain District Office, P.O. Box 1420, Battle Mountain, Nevada 89820.

Sincerely,

Ann J. Morgan
State Director, Nevada

Enclosure

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FINAL
ENVIRONMENTAL IMPACT STATEMENT
ROUND MOUNTAIN MILL AND TAILINGS FACILITY

Lead Agency:

U.S. Department of the Interior
Bureau of Land Management
Battle Mountain District Office

Project Location:

Nye County, Nevada

Correspondence on this EIS Should be Directed to:

Christopher Stubbs, EIS Project Manager
Bureau of Land Management
Battle Mountain District Office
P.O. Box 1420
Battle Mountain, Nevada 89820
(702) 635-4000

Date Draft EIS Filed with U.S. Environmental Protection Agency:

September 22, 1995

Date Final EIS Filed with U.S. Environmental Protection Agency:

February 16, 1996

ABSTRACT

The Smoky Valley Common Operation has submitted a *Plan of Operations Amendment* for the construction, operation, and reclamation of a mill and tailings facility at the Round Mountain Mine. The proposed facilities would comprise an expansion of the existing operation at the Round Mountain Mine to improve the recovery of gold from ore that is being mined from the existing open pit. Ancillary facilities would include a new primary crusher; a power line; fresh water, reclaim water, and tailings pipelines; and a septic system. The proposed facilities would be located on approximately 757 acres of public land administered by the Bureau of Land Management, Battle Mountain District Office, Tonopah Resource Area. Of this acreage, approximately 250 acres occur on public lands outside of the existing permit boundary. Construction is scheduled to begin in early 1996; operation of the mill and tailings facility would begin in 1997 and continue until 2008.

This Final Environmental Impact Statement analyzes the environmental impacts associated with the proposed mill and tailings facility and ancillary facilities, a range management alternative, an alternative tailings impoundment site, and the no action alternative. In addition, the environmental impact statement analyzes potential impacts associated with pit dewatering and pit water quality, and the leach offload piles.

Responsible Official for EIS:

Ann J. Morgan
State Director, Nevada

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SUMMARY

The Smoky Valley Common Operation (SVCO) has submitted a *Plan of Operations Amendment* to the Battle Mountain District Office of the Bureau of Land Management (BLM) for the construction, operation, and reclamation of a mill and tailings facility at the existing Round Mountain Mine site in Nye County, Nevada. The BLM reviewed the SVCO's *Plan of Operations Amendment* and determined that the proposed action had the potential to result in significant environmental impacts; therefore, the BLM determined that the preparation of an environmental impact statement (EIS) would be necessary.

The existing operation includes permitted activities on 3,659 acres of land administered by the BLM, 515 acres of land administered by the Toiyabe National Forest, and 593 acres of patented land owned by the SVCO. The proposed expansion would be located on approximately 757 acres, of which 250 acres would be located on lands administered by the BLM outside of the current permit boundary.

This EIS describes the proposed mill and tailings impoundment, the project alternatives (including the no action alternative), and the direct, indirect, and cumulative environmental impacts of implementing the proposed action or the project alternatives. This EIS also analyzes the potential environmental impacts associated with pit dewatering and pit water quality and the leach offload piles, which are components of the existing operation.

Proposed Action

The SVCO's proposed expansion includes the construction, operation, and reclamation of the following additional gold processing facilities and associated infrastructure at the existing Round Mountain Mine site:

- A gold mill to process up to 11,000 tons of unoxidized ore per day
- A new primary crusher rated at 11,000 tons per 8-hour day
- A tailings impoundment that would ultimately accommodate approximately 57 million tons of mill tailings
- An ore stockpile for the mill feed
- New power lines to accommodate power distribution requirements
- A cyanide destruction system to maintain non-toxic levels of weak acid dissociable cyanide in the tailings impoundment
- Tailings delivery pipelines for transporting tailings from the mill to the impoundment
- A reclaim water pipeline to return reclaim water from the impoundment to the mill
- A water pipeline to supply fresh water to the mill
- A septic system to support the mill
- New access/haul road
- Growth medium stockpiles

Project Alternatives

Alternatives to the proposed action include a range management alternative that would involve fencing a narrow grazing corridor between the proposed expansion and State Highway 376, a siting alternative for the tailings impoundment and associated process ponds, and the no action alternative.

Summary of Impacts

This section summarizes the anticipated impacts associated with the proposed mill and tailings facility, pit dewatering and pit water quality, and the existing leach offload piles. Where the impacts would differ for an alternative compared to the proposed action, this difference is noted.

Geology and Minerals

Direct impacts of the proposed action on geologic and mineral resources would include (1) the generation and permanent disposal of approximately 57 million tons of mill tailings, (2) the disturbance of approximately 757 acres of alluvial fan, and (3) the extraction of an additional 860,000 ounces of gold from the geologic resource. Under the proposed action, these direct impacts would not be mitigated.

Indirect impacts from the proposed action, including the potential for damage to the tailings facility from seismically induced slope instability, settlement, and deformation, are anticipated to be minimal over both the short and long term.

Impacts associated with the range management and tailings impoundment alternatives would essentially be the same as those resulting from the proposed action.

Water Quality and Quantity

Pit dewatering commenced in 1990 and is projected to continue until mine closure in 2008. Dewatering to date has lowered the average elevation of the ground water by approximately 500 feet. Under the current mine plan, continued mining will lower the ground water level an additional 300 feet in the vicinity of the pit. Pit dewatering will continue to decrease ground water levels in and around the pit. The predicted maximum extent of drawdown is limited to areas located within a 2.5-mile radius of the center of the pit. The impacts to the ground water table are not predicted to extend outside the western or southern margin of the mine property, but are predicted to extend approximately 0.5 mile north of the Round Mountain townsite; therefore, the water levels within wells in the Round Mountain townsite could potentially be impacted. Mine dewatering is not expected to significantly impact surface water resources since all perennial flowing streams and springs are located a substantial distance outside the predicted drawdown area.

Significant water quality impacts from the existing leach offload piles to waters of the state have not occurred. Analysis of historic and recent data suggests that the potential for leach residue material and the existing leach offload piles to significantly impact waters of the state over the life of the operation and after closure is minimal. There is the potential for meteoric water runoff from the leach residue piles to contaminate soils and subsequently affect vegetation, range, and wildlife resources.

Available data regarding the geochemical character of the tailings, native soil attenuation properties, facility design and operation procedures, and surface water and ground water transport mechanisms indicate that the potential for the proposed mill, tailings impoundment, associated facilities, or alternative tailings impoundment site to significantly impact waters of the state over the life of the operation is minimal. Seepage through the underdrain system is expected to decrease during operation, and the collection pond is anticipated to be dry before closure. If these conditions are not encountered, and tailings solution is still seeping through the underdrain system after the cessation of mine processing operations, the unanticipated seepage would create a potential impact to ground water.

Ground water flow modeling indicates that upon completion of mining and pit dewatering, a pit lake will begin to develop. The pit lake is predicted to be approximately 98 percent full after 160 years and to reach its final elevation approximately 330 years after the cessation of dewatering. However, the actual time required for the lake to fill may be shorter or longer depending on future climatic conditions. At the full lake stage, the pit lake elevation is predicted to be approximately 5,528[1] feet, with a surface area of approximately 155 acres and a depth of approximately 323 feet. Modeling of final ground water levels, flow rates, and predicted precipitation and evaporation rates suggests that the pit lake will have no net outflow to either ground or surface waters.

Geochemical modeling was used to predict the water quality in nine stages during the 330-year pit lake development period. Due to uncertainties of future climatic conditions, ground water flow rates, and ground water chemistry, the confidence in the predictions of pit lake water quality decrease with increasing time after the end of mining. Therefore, predictions made several decades or centuries in the future should be viewed as indicators of relative trends in concentration, rather than absolute values. Based on evaluations of thermal stratification and biological and chemical oxygen demand, the pit lake is predicted to be completely oxygenated during lake filling and at hydraulic steady state. The model predicts that the lake pH will steadily increase over the model period from 8.9 to 9.4; therefore, the lake is not anticipated to be acidic at any time. The model predicts that because of evaporation, total dissolved solids, fluoride, sulfate, and most metals will gradually increase in concentration over time.

Over the 330-year period, the pit lake is predicted to develop elevated concentrations of aluminum,

[1]Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

arsenic, fluoride, magnesium, nickel, sulfate, zinc, and total dissolved solids. However, since the numerical flow modeling indicates that the pit lake will not discharge to the surface or ground water, the pit lake water is not expected to degrade surrounding waters of the state. At closure, the perimeter security fence, rocky berm, and blasting of the access ramp (after water quality monitoring is complete) should preclude access to the lake for humans, large wildlife, and livestock. The only anticipated future beneficial use of the lake water is as a water source for waterfowl and small mammals.

The range management alternative would result in the same impacts to water resources as the proposed action. The tailings impoundment alternative would result in a greater potential for channel instability, erosion, and flooding.

Soils and Watershed

The proposed action would disturb a total of 757 acres, of which 250 acres would be outside the existing permit area. This additional disturbance area would be used primarily for the proposed tailings facility, which would be reclaimed following the termination of milling operations. Impacts on soil resources would include soil loss or a reduction in productivity as a result of project disturbance. Predicted soil losses would be within annual tolerances, and erosion would not significantly limit reclamation efforts.

The average recommended salvage depths for the soils within the area of the proposed action are listed in Table 3-15 of the Soils and Watershed section; these soils are considered generally suitable for reclamation.

The impacts to soils from the range management alternative would be less than those from the proposed action. The tailings impoundment alternative would disturb approximately 452 acres of soils, of which 439 acres would be outside the existing permit area. Recommended salvage depths for this site average 16.7 inches; these soils are considered generally suitable for reclamation.

Vegetation

The 250 acres of proposed additional disturbance outside the existing permit boundary would impact primarily the fourwing saltbush vegetation type (237 acres), with a small impact to the shadscale vegetation type (13 acres). These areas would be reclaimed following mine closure to a vegetation community including perennial grasses, forbs, and shrubs. It is likely that this reclamation community would remain distinct from the nearby undisturbed vegetation communities for a period of several decades. The proposed action would not affect any listed or proposed threatened or endangered plant species.

The range management alternative would alleviate the grazing impacts and associated vegetation degradation in the narrow corridor adjacent to State Highway 376, but would not alter the impacts from construction of project facilities and reclamation of the area following mining.

Vegetation impacts associated with the tailings impoundment alternative would include disturbance of approximately 439 acres outside the existing permit area. As with the proposed action, this area would be reclaimed to a mixed community of perennial grasses, forbs, and shrubs following mining. This alternative would not affect any listed or proposed threatened or endangered plant species.

Wildlife and Fisheries

Potential impacts to local wildlife would consist primarily of limited displacement or mortality of small mammals, reptiles, and invertebrates in the proposed tailings impoundment area. Increases in legal hunting would not occur because of the draw permit system used in Nevada; however, poaching, and roadkills of mule deer in the Big Smoky Valley area could increase with increased population.

Residual cyanide in the mill tailings would be neutralized before being discharged to the impoundment, and laboratory analyses indicate that the tailings material would not be toxic to wildlife. Thus, operation of the impoundment is not expected to result in toxicity losses to migratory waterfowl or local wildlife populations. Impacts to fisheries resources are unlikely given the intermittent and ephemeral nature of streams near the project site.

Geochemical analysis of the pit lake water quality (PTI 1995) indicated that chemical constituents would be present in sufficient quantities to warrant an ecological risk assessment (conducted by PTI 1995a). A screening-level assessment was conducted in which predicted environmental concentrations were compared to human health drinking water standards for mammals and to

toxicological benchmark values for mallards. The pit lake concentrations were also compared to aquatic life criteria. Risk to receptors from those chemicals for which predicted chemical concentrations exceeded screening criteria was evaluated using a food web modeling approach. Chemical uptake by receptors through ingestion of lake water, aquatic vegetation, and invertebrates, and incidental ingestion of sediment was estimated and compared to toxicity reference values for wildlife.

Results of the screening-level assessment indicate that antimony, cadmium, chromium, copper, iron, lead, manganese, selenium, silver, and thallium are unlikely to adversely affect mammals and that arsenic, copper, and lead are unlikely to adversely affect birds using the pit lake during the entire 330-year modeling period. On the basis of the results of the screening-level assessment, the risk of exposure of mammals to aluminum, arsenic, fluoride, mercury, nickel, and zinc were evaluated using the food web model. In addition, risks to birds from exposure to mercury, selenium, and zinc and risks to killdeer and cliff swallow from exposure to aluminum and silver were evaluated using the food web model.

The results of the food web modeling analyses indicate that if water ingestion is the only exposure route, the predicted median concentrations of all chemical constituents for which toxicity reference values are available are below levels that would pose a significant risk to wildlife populations. For the modeled scenarios, if water ingestion is the only exposure route considered, all hazard quotients for all chemicals are less than 1.0 in both the 0-to-159-year and 160-to-330-year modeling periods.

Assuming that killdeer, cliff swallows, and mallards obtain their food from the pit lake, risk to killdeer and cliff swallows from exposure to aluminum, mercury, selenium, silver, or zinc is negligible. There is no indication of risk to mallard populations from exposure to mercury through the ingestion of plants or aquatic invertebrates or the incidental ingestion of sediment. The exposure of mallards to selenium in both the 0-to-159-year and the 160-to-330-year scenarios exceeds the no-observed-adverse-effect level but does not exceed the lowest-observed-adverse-effect level for selenium, which indicates no significant risk to mallards from exposure to selenium. Exposure of all bird receptors to zinc in the long-term scenario is greater than the no-observed-adverse-effect level value, but exposure of killdeer and cliff swallows is less than the lowest-observed-adverse-effect level, which indicates no significant risk to killdeer and cliff swallows from exposure to zinc. Exposure of mallards to zinc could exceed the lowest-observed-adverse-effect level value in the 0-to-159-year modeling period by a factor ranging from 1.2 to 4.6 and in the 160-to-330-year modeling period by a factor ranging from 2.4 to 9.0.

In light of uncertainties, the zinc hazard quotient for mallards suggests that there may be impacts to individual waterfowl as a result of exposure to the pit lake based on the results of the ecological risk assessment, but population-level impacts are unlikely.

The proposed action would not affect any federally listed or candidate threatened or endangered wildlife species since the project area does not provide habitat for these species.

The impacts associated with the range management and the tailings impoundment alternatives would be similar to the proposed action. The pit water quality impacts associated with the no action alternative would be the same as the proposed action.

Range Resources

The proposed action would result in the direct loss of grazing forage on approximately 536 acres of rangeland including 250 acres outside the current permit boundary. This grazing impact would continue throughout the operation of the facility and during the subsequent reclamation period. This forage loss would be largely replaced after mine closure and reclamation of the disturbed area. In fact, successful reclamation would likely result in increased forage production from the affected areas. Additional grazing impacts are expected in the narrow corridor between the mining operation and State Highway 376 where livestock congregation is likely to result in permanent damage to the perennial vegetation community.

The range management alternative would alleviate the heavy grazing damage expected within the narrow corridor adjacent to the highway. This alternative would result in the loss of grazing on approximately 250 acres beyond the current permit area associated with proposed mine activities and the restriction of grazing on approximately 893 acres within the corridor. It would also require additional ranch operating costs to haul water to a new stock watering site south of the mine. This alternative is

also expected to result in temporary livestock congregation problems along the north side of State Highway 378 between the turnoff from State Highway 376 and the Round Mountain townsite.

The tailings impoundment alternative would alleviate some but not all of the expected livestock congregation in the corridor and near the mine dewatering channel. The loss of available forage outside the existing permit area would total 439 acres.

Paleontological Resources

There are no known paleontological resources in the project area; thus, no impacts to paleontological resources are anticipated.

Cultural Resources

No cultural resources that are eligible for the National Register of Historic Places occur in the area that would be disturbed by the proposed action or the alternatives; therefore, no impacts are anticipated. On-site studies and research have shown that there would be no impacts to Native American traditional values.

Air Quality

The proposed action is expected to result in slight increases in the levels of fugitive dust and inhalable particulates in the project vicinity, but these increases are not expected to exceed applicable standards or to significantly increase air quality impacts. Impacts associated with the project alternatives would be similar to those resulting from the proposed action.

Access and Land Use

The proposed action would involve the conversion of an additional 757 acres of rangeland to mining-related uses; 250 acres would be outside of the existing permit area. No direct land use conflicts with existing or proposed land use plans would be anticipated. The project would not affect access to public lands outside the immediate area of the planned facilities.

The range management alternative would involve removal of grazing on 250 acres of rangeland outside the existing permit area plus restriction of grazing on 893 acres within the corridor area between the mine and State Highway 376.

The tailings impoundment alternative would involve the conversion of approximately 439 acres of rangeland to mining use.

Recreation and Wilderness

The increased workforce associated with constructing and operating the proposed project would create minor increases in the demand for outdoor recreation in the region, but the changes are not expected to be noticeable since the population changes would be very small. Impacts associated with the range management and tailings impoundment alternatives would be the same as the proposed action.

Social and Economic Values

The proposed action would result in the employment of an average of 104 workers during the construction period and 43 permanent employees through the life of the operation. This additional construction employment would reach a peak in 1996 with 200 employees. The project would generate approximately $13.9 million in payroll during the 14-month construction phase and an annual payroll of approximately $2.3 million during operations. The local housing supply is considered adequate to serve the increased population demands. The increased population may create a small financial shortfall for public utilities and services until the increased tax revenues associated with the project are realized.

The range management and tailings impoundment alternatives would result in the same impacts to social and economic values as the proposed action.

Visual Resources

Development of the proposed tailings impoundment and associated facilities would result in an increase in visual impacts to travelers along State Highway 376 from the south. These impacts are considered compatible with the BLM's Visual Resource Management objectives if they are adequately mitigated by effectively reclaiming the impoundment slope facing the highway.

Development of the range management alternative would result in visual impacts similar to the proposed action. The tailings impoundment alternative would result in a similar scale of visual impacts, but they would be more noticeable to residents of the

Round Mountain townsite and travelers from the north on State Highway 376.

Noise

The proposed action would generate slightly increased noise levels for Hadley residents, particularly during the construction and reclamation phases of the project while heavy equipment is operated at the tailings impoundment site.

The range management alternative would not affect the noise levels generated by the project. The tailings impoundment alternative would generate noise levels similar to the proposed action, but they would be more noticeable to residents of the Round Mountain townsite and less noticeable to residents of Hadley.

Hazardous Materials

The proposed action may result in potential impacts to environmental resources caused by an accidental release or spill of hazardous materials transported to, stored, and used at the site. The significance of the impact would depend on the spill location and sensitivity of the resources present at the spill site should protective measures not contain the release.

Agency Preferred Alternative

The BLM's preferred alternative is to implement the range management alternative in conjunction with the proposed action. This alternative was selected because it would encourage better grazing distribution in the project area grazing allotments and would improve vegetation in the corridor between the Round Mountain Mine and State Highway 376.

1.0 Introduction

CHAPTER 1.0 Introduction

The Smoky Valley Common Operation (SVCO) has submitted a *Plan of Operations Amendment* to the Battle Mountain District Office of the Bureau of Land Management (BLM) for the construction, operation, and reclamation of a mill and tailings facility at the Round Mountain Mine site in Nye County, Nevada (***Figure 1-1***). The proposed facilities would comprise an expansion of the existing operation at Round Mountain. The existing facilities are located on patented and unpatented mining and mill site claims administered by the BLM and the Forest Service and managed by Round Mountain Gold Corporation for Echo Bay Mines, Inc., Homestake Mining Company, and BaRGOLD, Inc. The patented land is owned by the SVCO.

The proposed mill and tailings facility would be located on public land administered by the BLM; therefore, the review and approval of the SVCO's *Plan of Operations Amendment* is subject to compliance with the Federal Land Policy Management Act and with the associated surface management regulations (43 Code of Federal Regulations 3809).

Because of the potential for the proposed project to result in significant environmental impacts, the BLM determined that an environmental impact statement (EIS) would be necessary. The BLM is serving as the lead agency for preparing the EIS in compliance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality regulations for Implementation of Procedural Provisions of NEPA (40 Code of Federal Regulations 1500-1508), and the BLM's NEPA Handbook (H-1790-1).

This EIS describes the proposed mill and tailings impoundment, the project alternatives, and the environmental consequences of implementing the proposed action or the project alternatives, including the no action alternative.

In addition to the proposed mill and tailings facility, this EIS analyzes the potential environmental impacts associated with pit dewatering and pit water quality and the existing leach residue (offload) piles.

1.1 Purpose and Need

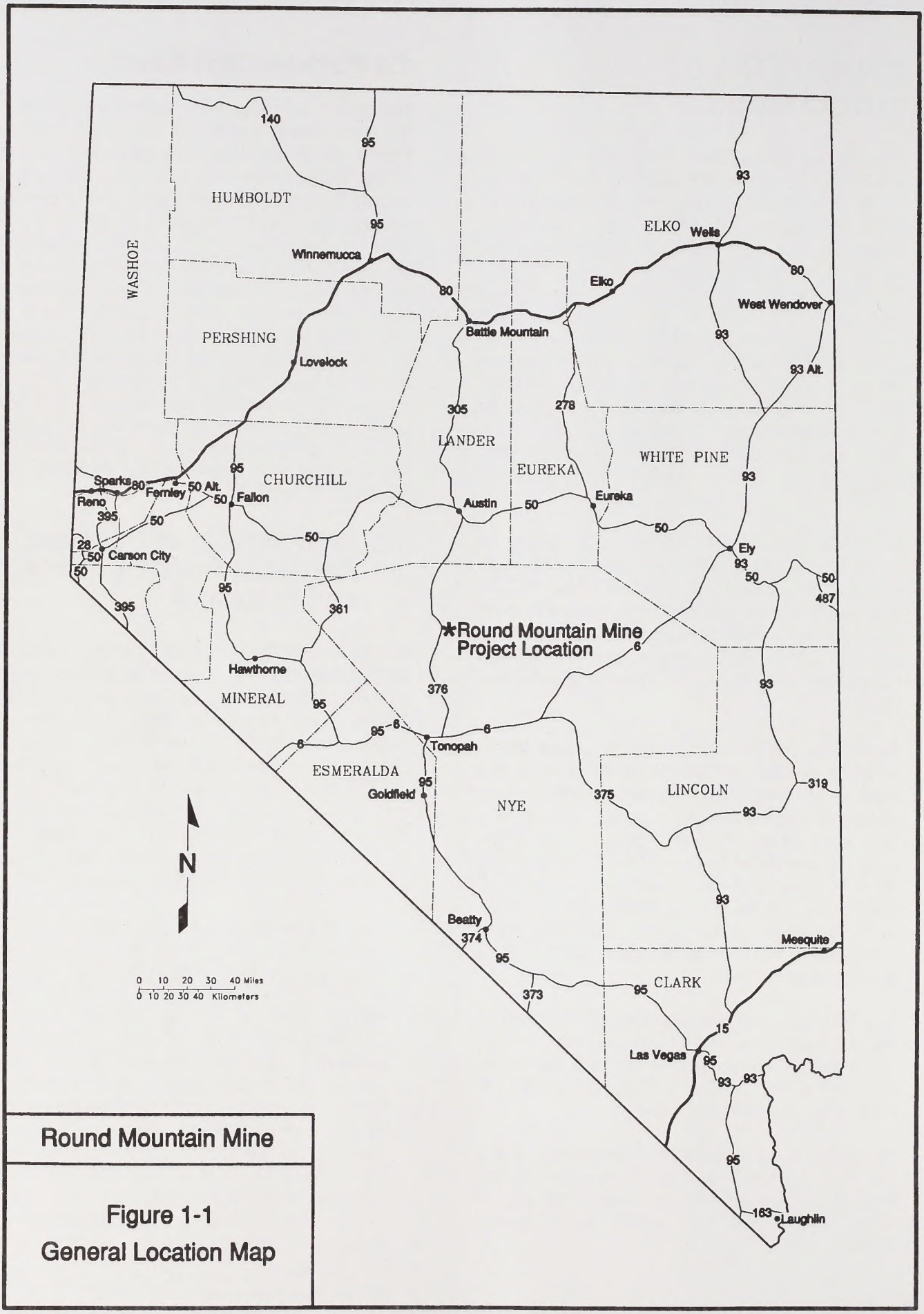
The SVCO proposes to construct and operate a mill and tailings facility as part of the existing Round Mountain Mine. The proposed mill and tailings facility are needed to improve the recovery of gold from ores that are being mined from the existing open pit. The recovery of gold and silver from unoxidized and other ore is anticipated to increase from approximately 36 percent using the existing heap-leach facilities to approximately 85 percent with the proposed mill. No changes to the development and operation of the permitted open pit and associated overburden rock piles or the heap-leach operations are proposed by this addition. Mining, overburden rock disposal, and heap leaching will continue as described in previous plans of operations approved by the BLM, the Nevada Division of Environmental Protection, and the Forest Service.

1.2 Relationship to BLM and Non-BLM Policies, Plans, and Programs

The BLM considers hard rock mining a valuable land use and has encouraged mineral exploration as an objective in its *Tonopah Resource Area Management Framework Plan Decisions and Tonopah Grazing Environmental Impact Statement Record of Decision* (BLM 1981). In this document, the BLM states in objective M-1 that it will "encourage mineral exploration by keeping lands open to operation of the mineral location and leasing laws to the maximum extent possible." The rationale given for this objective is as follows (BLM 1981):

> The mining laws were enacted to promote exploration and development of mineral resources...A disproportionately large amount of the nation's mineral wealth is found in the eleven western public domain states. Excluding iron, three-quarters of domestic metallic production, including 90% of the copper, comes from these states. The prime source of new exploration and development targets within these states is national resource land. Within the Tonopah Resource Area, virtually all land is either NRL [national resource lands[1]] or National Forest. It is vital to the continued health of the mining industry within the Resource Area, and to the

[1] The term "national resource lands" is synonymous with the more current term "public lands."



Round Mountain Mine

Figure 1-1
General Location Map

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maintenance of our industrial economy, that national resource lands be kept open to operation of the mineral location and leasing laws.

The conformance of the proposed project with other land use plans and policies is evaluated in Section 3.10, Access and Land Use.

1.3 Authorizing Actions

In addition to the BLM's approval of the SVCO's *Plan of Operations Amendment*, there are other federal, state, and local agencies with jurisdiction over certain aspects of the proposed project. ***Table 1-1*** lists the required permits or approvals and the responsible regulatory agency.

TABLE 1-1
Environmental Regulatory Requirements

Permit or Approval	Regulatory Agency
Plan of Operations Approval	U.S. Department of the Interior, Bureau of Land Management; Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
Nationwide Permit 26, Headwaters and Isolated Waters Discharges	U.S. Army Corps of Engineers
Artificial Pond Permit	Nevada Department of Conservation and Natural Resources, Division of Wildlife
Air Quality Permit to Construct and Air Quality Permit to Operate	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
Water Pollution Control Permit	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
Mine Reclamation Permit	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
Permit for Dam Construction	Nevada Department of Conservation and Natural Resources, Division of Water Resources
Permit to Construct and Operate Sanitary Leach Field	Nevada Department of Health

2.0 Description of the Proposed Action and the Alternatives

CHAPTER 2.0 Description of the Proposed Action and the Alternatives

2.1 Introduction

The proposed action represents a modification of the SVCO's current gold mining and processing operations at the Round Mountain Mine near the community of Round Mountain, Nevada. As a basis for evaluating the environmental impacts anticipated to result from the proposed action, this chapter provides a description of the existing mining, leaching, and gold recovery operation; the proposed additional facilities, including the mill and tailings impoundment; and alternatives considered to address environmental issues raised during the public scoping process. Also provided in later sections of this chapter are a discussion of the agency preferred alternative and a summary comparison of the environmental impacts anticipated from the proposed action and the alternatives, including the no action alternative.

2.2 Existing Operations

The existing Round Mountain Mine operation consists of an open-pit mine, overburden rock and leach offload piles, reusable asphalt-lined leach pads, active and inactive dedicated (single-use) leach pads, lined solution ponds, processing or adsorption/desorption and refinery plants, and ancillary facilities. These operational components are depicted in ***Figure 2-1*** and are described in the following paragraphs of this section.

2.2.1 Location and Land Ownership

The existing Round Mountain Mine is located in the Big Smoky Valley within portions of Sections 13, 23, 24, 25, 26, 35, and 36 of T10N, R43E; Sections 18, 19, 20, 29, 30, and 31 of T10N, R44E; Section 6 of T9N, R44E; and Sections 1 and 2 of T9N, R43E on a combination of patented and unpatented mining and millsite claims. The mining operations are managed by the Round Mountain Gold Corporation for the SVCO joint venture owners, including Echo Bay Mines, Inc., Homestake Mining Company, and BaRGOLD, Inc. The patented lands are owned by the SVCO. The proposed mill and tailings facility would be located on public land administered by the BLM. ***Figure 2-2*** illustrates the surface ownership in the vicinity of the existing and proposed operations.

The site is accessed via State Highway 376 from either Austin or Tonopah, which are approximately 54 and 45 air miles north and south of the site, respectively.

2.2.2 History of Exploration and Mining

The Round Mountain site has been the focus of mining operations since 1906. From 1906 to the early 1960s, gold from surface alluvial deposits were recovered using open-pit and placer mining techniques. Underground mining also occurred during this time. Later operations (up to 1969) included the addition of a gravity separation plant. Exploration conducted from 1970 through 1976 identified a substantial lode deposit; reserves were proven and an open-pit mining and heap-leaching operation began in late 1976, with the first doré bar being cast in 1977.

Previous plans of operations and related amendments for mining operations at Round Mountain are summarized in ***Table 2-1***. Through a series of mine expansions and modifications from 1981 through 1991, the mine has evolved to its current size and configuration. Present operations include permitted activities on 3,659 acres of land administered by the BLM, 515 acres of land administered by the Toiyabe National Forest, and 593 acres of patented land owned by the SVCO.

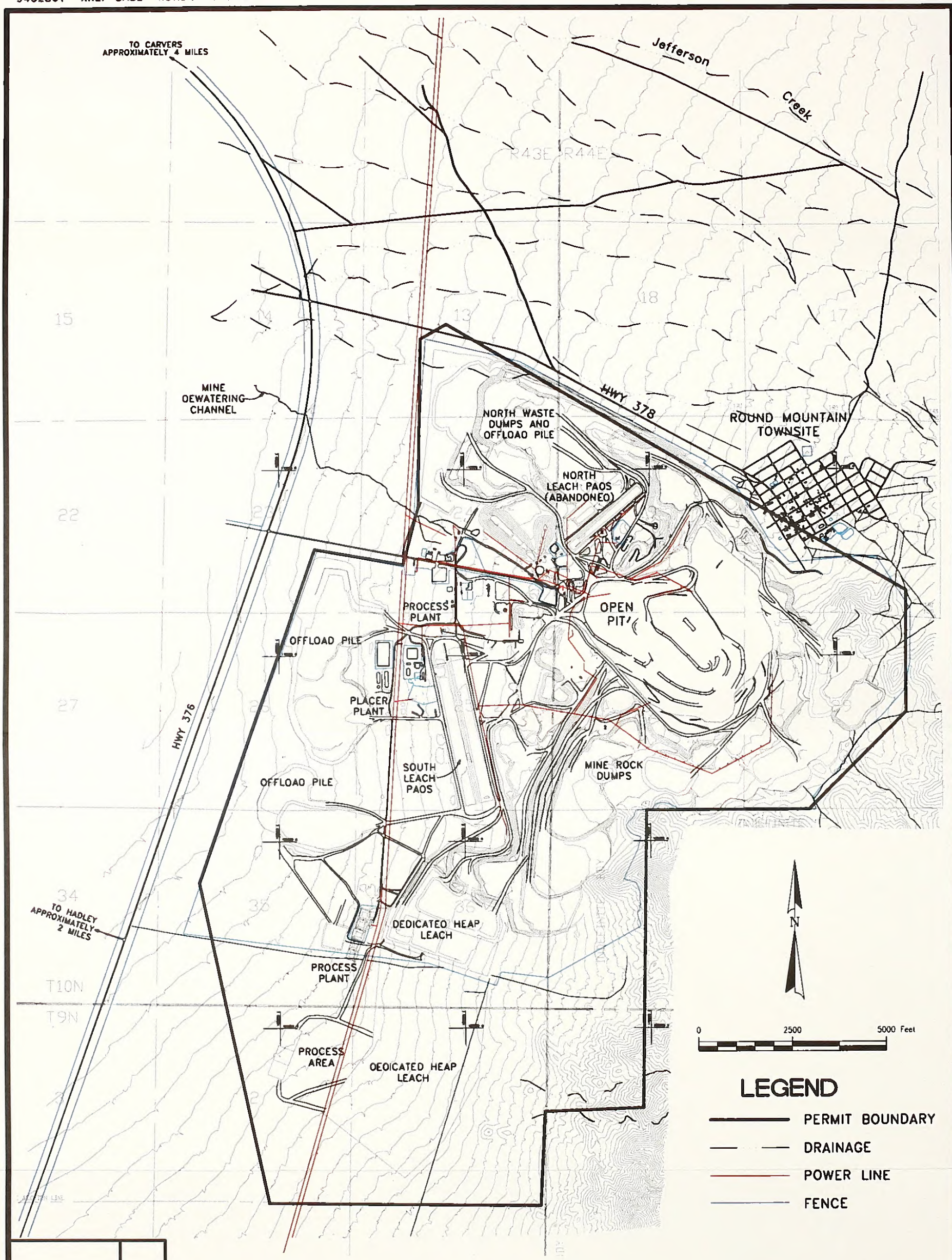
2.2.3 Geology and Mineralization

The geology of the Round Mountain area is composed of (from oldest to youngest) metasedimentary rocks, granite, volcanic tuffs, and alluvium. Paleozoic metasedimentary rocks intruded by the Cretaceous Shoshone Granite form the basement throughout the area. The Paleozoic rocks consist of quartzite, phyllite, and argillite. During the Tertiary, approximately 20 to 40 million years ago, the basement rocks were overlain by a sequence of welded tuffs deposited by a series of volcanic eruptions. The steep contact between the volcanic rocks and metasediments in the pit area is inferred by the mine geologists to be the buried margin of a caldera (a large, faulted volcanic vent area). This faulted structure is believed to have played a primary role in localizing gold mineralization at the

TABLE 2-1
Operations at the Round Mountain Site Since 1981

Date	Activity
April 1981	Round Mountain Mine owner/operator Copper Range Company submits *Plan of Operations* NV-060-P01-9 to BLM for 134.4 acres of proposed disturbance on BLM land for employee housing and recreation facilities, exploration drilling, and mine activities. Prior disturbance was approximately 700 acres, including an undeclared amount of patented land.
June 1983	*Plan of Operations* NV-060-P01-9 is amended to become *Plan Amendment* NV-060-PO1-9A. The amendment proposes a total of 596 acres of surface disturbance on BLM land for overburden disposal, leach pads, haul roads, housing, and mining activities. Patented land disturbance of 262 acres are not included in this total.
March 1984	*Plan Amendment* NV-060-PO1-9A is amended to become *Plan Amendment* NV-060-PO1-9B; no additional disturbance is proposed.
January 1985	Echo Bay Mines, Ltd. purchases the Copper Range Company.
May 1985	Echo Bay Mines, Ltd. submits *Plan Amendment* NV-060-PO1-9B to the BLM for a total of 776 acres of proposed surface disturbance on both BLM and Forest Service land for expansion of overburden disposal and the pit. *Operating Plan* 04-84-024 is submitted separately to the Forest Service for approval of the 115 acres of surface disturbance on Forest Service land.
December 1986	The SVCO acquires control of the Round Mountain mining claims. The SVCO submits *Plan Amendment* N65-81-009P for an expansion of the existing open pit; construction of overburden piles, a heap-leach facility, and an employee housing development; and upgrading of utilities and ancillary facilities. The total proposed surface disturbance is increased to 1,218.5 acres on BLM and Forest Service lands (excluding patented land).
October 1987	The SVCO submits *Plan of Operations* N65-87-003P and an Environmental Assessment is conducted for the expansion of the open-pit mine and overburden piles and construction of a leach pad, leach offload disposal area, processing plant, and ancillary facilities. The total proposed surface disturbance is increased to 2,034 acres on BLM and Forest Service lands (excluding patented land).
January 1988	The SVCO submits *Plan of Operations* D4-88-016 and an Environmental Assessment is conducted for 400 acres of additional surface disturbance from deposition of overburden material on Forest Service land. The total proposed surface disturbance on BLM and Forest Service lands to date is 2,434 acres.
November 1991	An amendment to *Plan of Operations* N65-87-003P is submitted to the BLM and an Environmental Assessment is performed for the proposed construction of a dedicated leach facility to treat run-of-mine ore, and extension and reconfiguration of the south and north overburden rock piles. The approved plan as defined in the Environmental Assessment will result in a total of 826[1] acres of additional disturbance on BLM lands. The total revised proposed disturbance as a result of all approved amendments to the *Plan of Operations* is 4,767[2] acres consisting of 3,659 acres on BLM land, 515[3] acres on Forest Service land, and 593 patented acres.

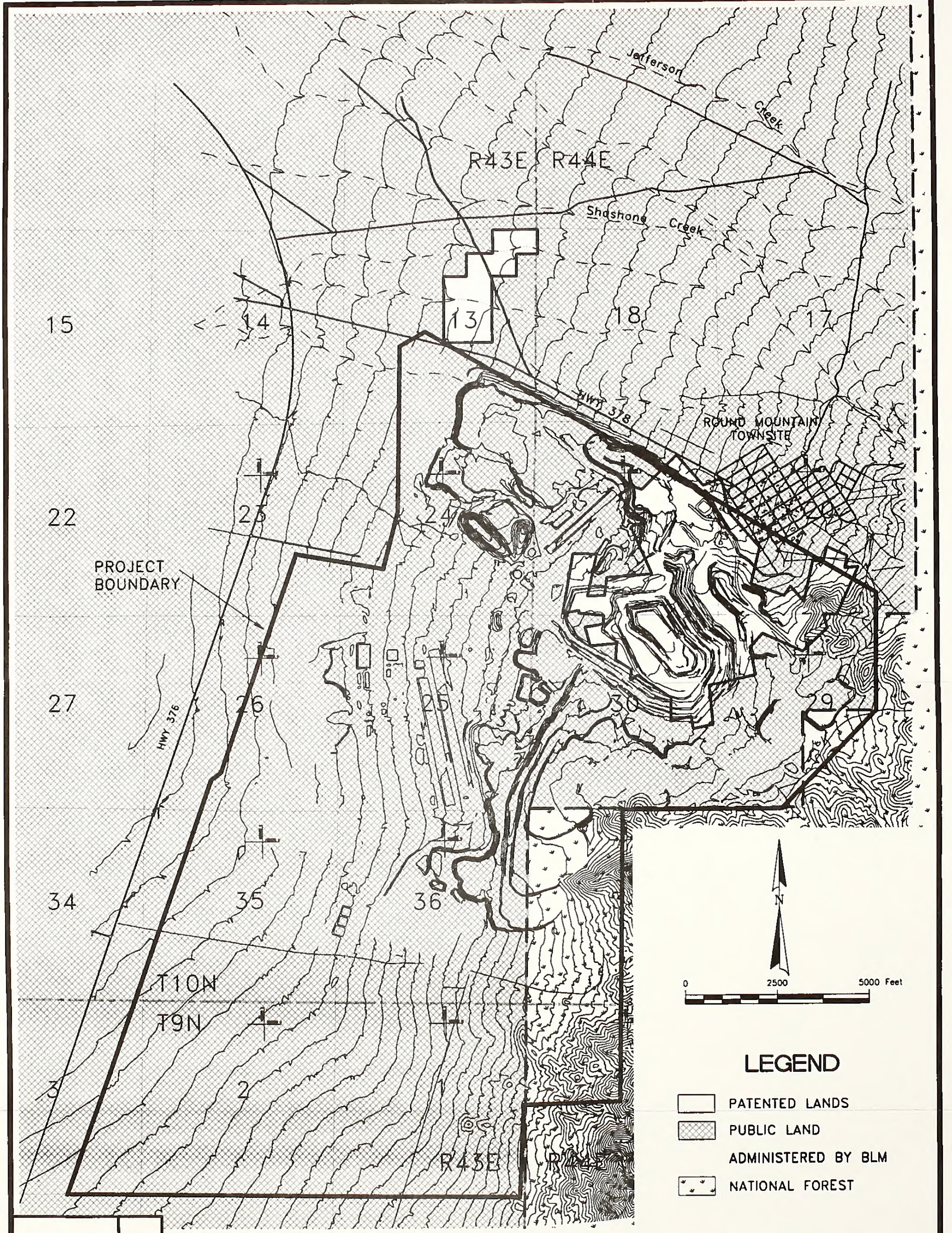
[1] Note that the 826 acreage expansion was addressed in the 1992 Environmental Assessment (p. 2-5); however, this acreage differs from the 638 reported in the Plan of Operations (WESTEC 1992).
[2] Based on the calculated acreages provided in WESTEC 1992.
[3] The 515 acres is corrected from the 555 acres reported in the 1992 Environmental Assessment (p. 2-4) and includes 115 acres approved for Operating Plan 04-84-024 and 400 acres for Operating Plan 04-88-016.



Round Mountain Mine

Figure 2-1
Existing Permitted Facilities

Source: Modified from RMGC 1995 (Site Plan)



Round Mountain Mine

Figure 2-2
Land Status Map

Source: RMGC 1995 (Land Status)

Round Mountain Mine site. The ore deposit was created as hydrothermal solutions transported gold, silver, and other metals from the basement rocks into the overlying volcanics.

Approximately 10 million years ago, the region was subjected to Basin- and Range-style faulting that has resulted in the formation of north- to northwest-trending, fault-bounded mountain ranges (such as the Toiyabe and Toquima Ranges located west and east of the mine, respectively) separated by downdropped alluvial-filled valleys (such as the Smoky Valley).

Mineralization at Round Mountain occurs in an irregularly oxidized, hydrothermally altered zone that extends to a depth of approximately 2,000 feet. The host rock for the ore mineralization consists primarily of rhyolitic and ash-flow tuffs, with localized mineralization in the underlying Paleozoic sequence, as summarized in ***Table 2-2***.

Gold at Round Mountain occurs predominantly as electrum, a naturally occurring alloy of gold and silver, in an approximate ratio of 2:1. Most of the electrum is microscopic, although larger specimens up to approximately 6 inches in diameter have occurred.

Exploration drilling has defined an unoxidized, relatively high-grade vein system that extends to the southeast of the current pit (Spickelmeir 1993). The proposed mill and tailings facility would be constructed to efficiently recover gold from unoxidized clayey areas encountered in the pit.

2.2.4 Mining Operations

Mining at the Round Mountain site is conducted using conventional open-pit methods, including blasting, loading, and hauling. Ore and overburden rock are blasted using ammonium nitrate and fuel oil explosive; the ore and overburden are then loaded into 85-, 150-, or 190-ton haul trucks using front-end loaders and electric shovels. Blasted ore is hauled to either the south crushing plant or the new dedicated leach pad. Most of the low-grade material used on the dedicated leach pad was formerly placed into the overburden rock piles.

Current mining operations produce approximately 180,000 tons of ore and overburden rock per day. Mining operations proceed 24 hours per day, 7 days per week, with the exception of 10 days per year observed as holidays. Current mine reserves are estimated at 275 million tons of ore and 300 million tons of overburden rock. At the current mining rate, the open pit has a projected life of an additional 12 to 15 years. The development and operation of the proposed milling facility would not significantly affect the current mining operations, since the higher grade ore is presently being mined and placed on the south reusable leach pad or stockpiled.

Note: All elevations outside of the project boundary are above mean sea level in reference to the U.S. Geological Survey datum. Those elevations inside the project boundary are referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum. For clarity, all elevations referenced to the SVCO datum are footnoted.

2.2.4.1 Open Pit

The Round Mountain open-pit area is approximately 5,200 feet by 4,400 feet; the lowest bench bottom is at an elevation of approximately 5,590[1] feet. Current ore reserves indicate that in its ultimate configuration, the open pit will encompass an area of 6,900 feet by 4,500 feet and will bottom at an elevation of approximately 5,205[1] feet. Surrounding natural surface elevations range from 6,200 to 6,600 feet. Pit benches are approximately 35 feet high and 15 feet wide; every sixth bench is approximately 50 feet wide. Pit access is provided by an 8 percent ramp.

Ground water flow modeling indicates that upon completion of mining operations, the open pit will partially fill with ground water and create a pit lake. The pit lake is predicted to reach 98 percent of full recovery after approximately 160 years and full recovery approximately 330 years after the cessation of pit dewatering. At full recovery, the final pit lake elevation is predicted to be 5,528[1] feet, with a maximum depth of 323 feet and a surface area of 155 acres (Hydro-Search, Inc. 1994c).

The SVCO is currently dewatering from four in-pit wells. The pit dewatering water is pumped to a holding tank for temporary storage, loaded into water trucks, and subsequently used for dust control on haul roads. Water exceeding that required for dust control is recharged to ground water in the valley below the mine site through a

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

TABLE 2-2
Round Mountain Mine Mineralization

Rock Type	Description	Mineralization Characteristics	Oxidation of Ore
I	Densely welded tuff	Quartz-pyrite gold-bearing veins and stockwork	Oxidized
II	Poorly welded tuff	Gold and pyrite in veins and disseminations	Mostly oxidized
III	Older lithic tuff	Quartz-carbonate gold veins	Only a portion is oxidized
IV	Paleozoic metasediments	Quartz-carbonate gold veins	Partially oxidized

rapid infiltration basin permitted as Nevada Division of Environmental Protection Permit to Discharge NEV91030. This discharge ranges from approximately 200 to 600 gallons per minute. Discharge water quality meets state drinking water standards.

2.2.4.2 Overburden Rock Piles

Assuming a 12-year mine life, a total of approximately 578 million tons of overburden rock will be placed in the overburden piles. These piles are constructed by end-dumping, and active dump faces are at approximately the angle of repose. The overburden rock piles are benched and resloped to an overall slope of 3 horizontal to 1 vertical.

Overburden rock materials in the Round Mountain pit can be broadly classified into four different rock types (***Table 2-2***), each of which has been tested for acid generation, potential/acid neutralization potential, and Nevada Division of Environmental Protection meteoric water mobility (WESTEC 1991). An analysis of these materials is presented in Section 3.1, Water Quality and Quantity.

2.2.5 Processing Operations

2.2.5.1 Crushing

Normally, ore destined for the reusable leach pads is crushed prior to placement on the pads. The south crusher is a tertiary crushing plant that operates 24 hours per day, 7 days per week, excluding scheduled preventative maintenance shifts and holidays. The circuit processes approximately 20,000 tons of ore per day.

Ore is conveyed to the south reusable leach pads and loaded using a conveyor-fed mobile stacker. The stacker traverses the length of the pad, stacking ore to a median heap height of approximately 35 feet. At the end of the pad, the stacker pivots 180 degrees on a prepared ramp, allowing it to access the second pad and load ore in the opposite direction in a similar manner.

2.2.5.2 Leaching

Heap leaching has occurred on the north and south reusable leach pads and a dedicated leach pad. The south reusable leach pads and the dedicated leach pad are currently in use; use of the north reusable leach pad ceased in 1993.

The heap-leach processing circuit currently used at the south reusable leach pads is shown schematically in ***Figure 2-3***. The dedicated pad heap-leach circuit is shown in ***Figure 2-4***. Ore is leached by a drip system that applies a diluted solution of sodium cyanide, approximately 0.5 pound of sodium cyanide per ton of solution, at a pH of 10 to 11. To maintain the proper pH, quicklime is added to the crushed ore prior to placement on the leach pads. The crushing circuit is equipped with lime silos located above the conveying system, where lime is added at the rate of 2 to 5 pounds per ton of ore.

Each of the two south parallel reusable leach pads is divided into sections that average 45,000 tons each. The dedicated leach pad is divided into phases, each of which will contain various tonnages. As each leach pad section or phase is loaded, leach solution pipelines are placed across and down the sides of the ore heap. Barren or lean solution, depending upon the leaching cycle, is applied to the south reusable heaps using a drip system at the rate of approximately 0.004 gallon per square foot per minute. The total solution application rate (lean and barren) to the two reusable pads is approximately 10,000 to 11,000 gallons per minute. Barren solution is also applied

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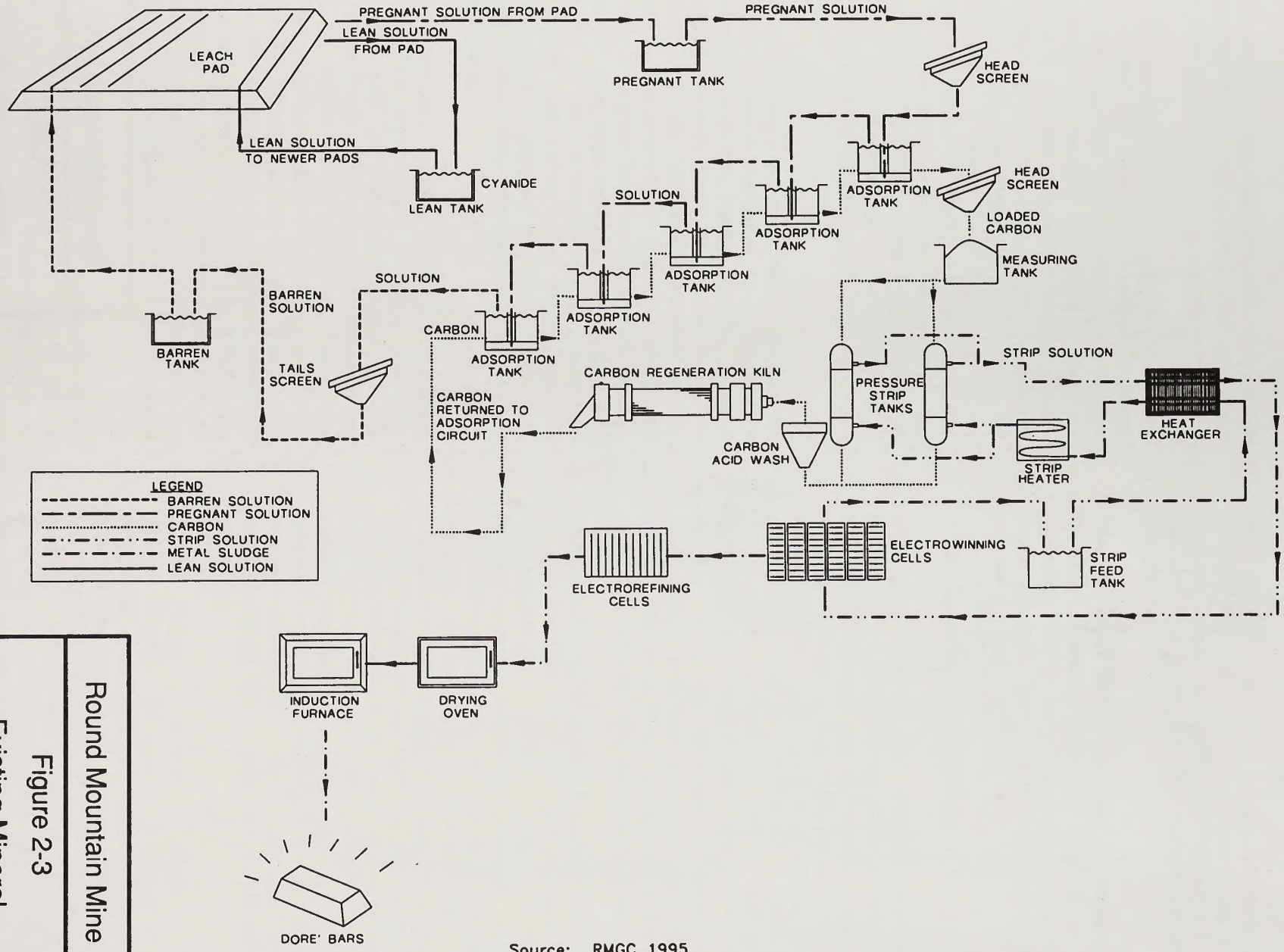
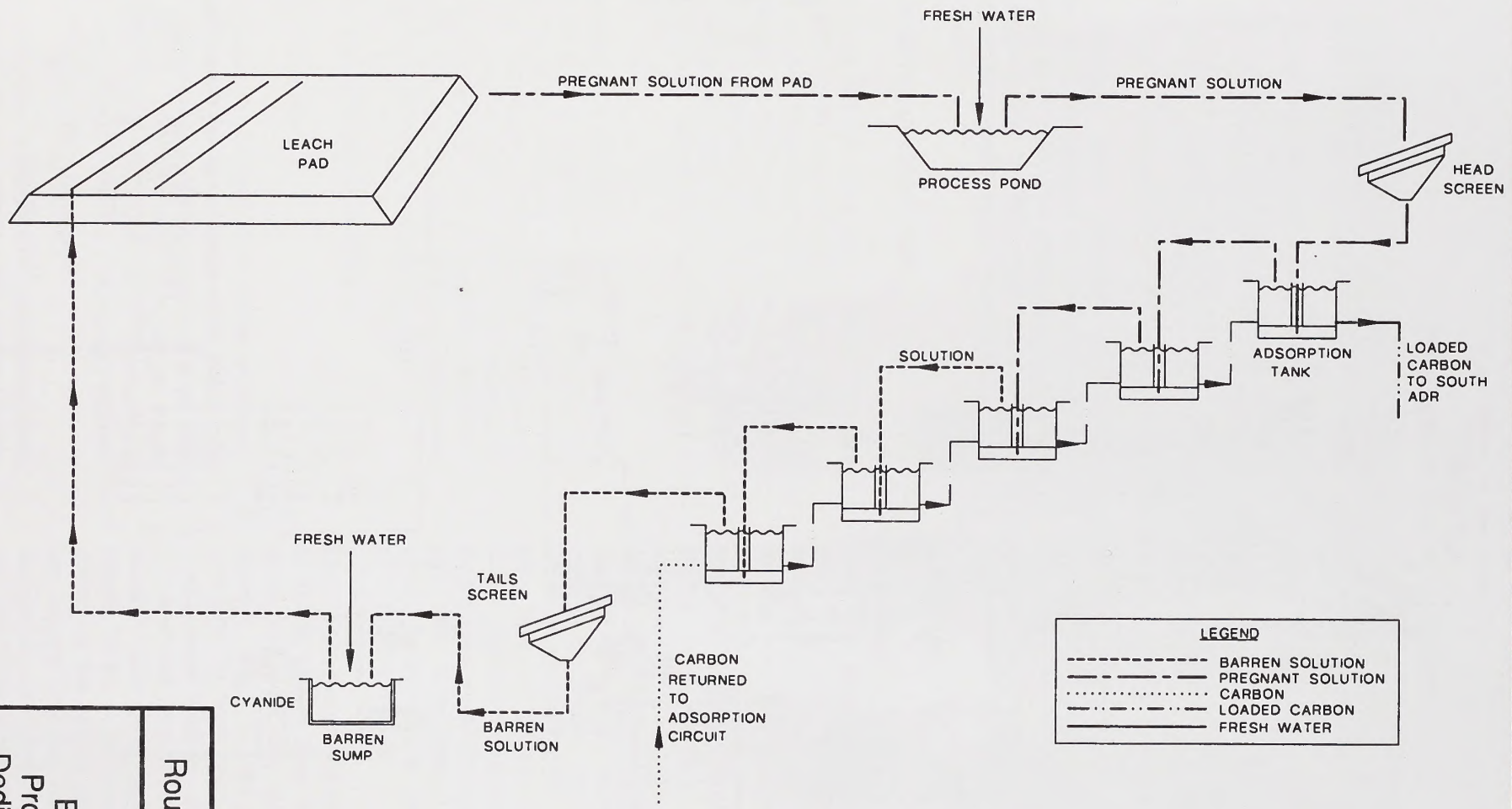


Source: RMGC 1995

Round Mountain Mine

Figure 2-3

Existing Mineral Processing Circuit - Reusable Leach Pads



Round Mountain Mine

Figure 2-4

Existing Mineral Processing Circuit - Dedicated Leach Pads

Source: RMGC 1995

to the dedicated pad using drip emitters at the rate of approximately 0.003 to 0.004 gallon per square foot per minute.

As the leaching solution percolates through the heaps, gold and silver form cyanide complexes that are dissolved into solution. The resulting pregnant solutions flow downgradient along the pad liners and are collected in covered solution collection ditches located along the downgradient edge of each pad. Pregnant solution from the leach pads is routed to a process pond for temporary storage or directly to the process plant. In the processing or adsorption/desorption and refinery plant, pregnant solution is processed to recover the dissolved gold and silver and is recycled back to the heap-leach pads as barren solution.

The SVCO uses a two-cycle leaching process for the south reusable leach pads. Newly stacked ore is leached using lean solution, and the resulting pregnant solution from the newer heaps is processed in the adsorption/desorption and refinery plant to recover gold and silver. The barren solution is recycled back to the pads and dripped onto the older heap sections. The resulting lean solution is not processed in the adsorption/desorption and refinery plant, but the cyanide concentration is adjusted, and the lean solution is recycled back onto the newer heap sections (***Figure 2-3***).

Ore on the south reusable leach pads is leached for a cycle of approximately 150 days. Upon completion of each leaching cycle, that section of the leach pad (20,000 tons average) is allowed to rest (i.e., no solution is applied) for 24 hours. The section is then rinsed for 1 to 5 days using fresh water and allowed to drain for 1 to 3 days. The fresh water application rate is approximately the same as the normal leaching rate of 0.004 gallon per square foot per minute. Approximately three to five sections, which average 45,000 tons each, are stacked and unloaded weekly on the reusable pads.

To improve the recovery of metals during the winter, the barren and lean solutions are heated before being applied to the reusable leach pads. At the south reusable leach pad facilities, hot geothermal waters are used to heat leaching solutions. The barren and lean solutions are heated by 180°F geothermal water in a non-contacting heat exchanger to a temperature of 60°F to 65°F. The solution exits the heap at a temperature of 40°F to 45°F. Following use in the heat exchanger, the geothermal waters are re-injected to the same geologic formation from which they originated.

The dedicated leach pad uses a single-cycle leaching process (***Figure 2-4***). Each lift on the dedicated pad is leached for a cycle of approximately 90 days. Approximately 1.3 million tons of material is leached during a cycle.

2.2.5.3 Gold Recovery Facilities

There are currently two solution processing facilities at the Round Mountain Mine: the south adsorption/desorption and refinery plant and the dedicated pad adsorption facility. A third facility, the original or north adsorption/desorption and refinery plant, was decommissioned in 1993. The SVCO uses conventional carbon adsorption techniques to recover precious metals. Pregnant solution enters the adsorption/desorption and refinery plants and flows through a series of five fluidized carbon adsorption tanks, after which it is recycled to the leach pads as barren solution.

Carbon previously stripped of precious metals is fed into the fifth adsorption tank and advanced counter-currently to the flow of pregnant solution. As the activated carbon and pregnant solution travel counter-currently through the adsorption tanks, the gold and silver cyanide complexes in the pregnant solution are adsorbed onto the activated carbon. Loaded carbon from the first adsorption tank is removed and advanced to the pressure strip system. The pregnant solution flow rate through the south adsorption/desorption and refinery plant is approximately 6,000 gallons per minute. Lean solution is recirculated back to the reusable pads at the rate of 4,000 to 5,000 gallons per minute.

Loaded carbon is stripped by pumping hot caustic solution through the carbon in a pressurized vessel. As the solution contacts the carbon, the gold and silver complexes are desorbed and recovered back into solution. The resulting concentrated pregnant solution is forwarded to electrowinning cells, where gold and silver are plated onto steel-wool cathodes. The doré bars produced at the facility contain approximately 65 percent gold and 35 percent silver. The bars are shipped to a refinery for final processing.

Following pressure stripping, carbon is washed with fresh water, washed with a 3 percent nitric acid solution, thermally regenerated in a rotary kiln, rinsed, neutralized, and recycled back to the adsorption tanks.

2.2.5.4 Leach Offload Piles

Following leaching and rinsing, ore is removed from the south reusable leach pads using front-end loaders, placed into haul trucks, and hauled to the closest south leach offload pile (***Figure 2-1***). These piles are constructed by end-dumping, and working faces approximate the angle of repose. During final reclamation, the working faces will be recontoured to a slope of approximately 3 horizontal to 1 vertical. As currently planned, the south leach offload piles would contain approximately 323 million tons of processed ore at the time of mine closure. The north leach offload pile, composed of run-of-mine waste rock and offloaded spent ore from the north reusable leach pad, was used from 1976 until 1994. Concurrent reclamation of the leach offload piles is ongoing.

In April 1991, an intensive drilling, sampling, and analysis program was undertaken to characterize the overburden rock as well as the leach offload material, i.e., the ore materials that had been leached, rinsed, and drained (WESTEC 1991). In October 1992, a sampling, analysis, and hydrogeologic program was undertaken to further characterize the offloaded leach material and any potential to affect the hydrogeologic system surrounding the Round Mountain site (Hydro-Search, Inc. 1993). The results of this investigation and an evaluation of the potential hydrogeologic impacts associated with the leach offload piles are presented in Section 3.1, Water Quality and Quantity.

2.2.5.5 Placer Plant

The placer facility uses gravity to separate coarse, free gold from ore encountered in high-grade open-pit veins. The plant is located approximately 1,000 feet south of the south adsorption/desorption and refinery process plant; the location of the plant is shown in ***Figure 2-1***.

It is estimated that because of weather constraints, the placer plant will operate approximately 275 days per year, with a throughput of approximately 1,000 tons per day (one 10-hour shift). In contrast to a mill that uses grinding and leaching to liberate precious metals, placer recovery relies on the high density of gold, which is not bonded to other materials.

Tailing streams generated from this ore by the gravity separation equipment may contain amounts of precious metals that could be economically beneficial. All tailing streams are stockpiled for possible future processing.

2.2.6 Ancillary Facilities and Infrastructure

2.2.6.1 Mine Water System

Fresh water for the Round Mountain Mine is supplied from three wells located approximately 4.5 miles west of the mine. Water is pumped from these wells to the mine site in a 22-inch-diameter polyethylene pipeline. Fresh water is stored in two water tanks, and potable water for the mine site is stored in a separate tank and is chlorinated to meet the Nevada Consumer Health Protection Services' standards.

2.2.6.2 Electricity

Electricity for the Round Mountain Mine is supplied from a 230-kv transmission line traversing the Big Smoky Valley from north to south. A 230-kv substation is located northwest of the south processing plant (***Figure 2-1***). Two stepdown transformers convert the 230-kv electrical power to 24.9 kv.

2.2.6.3 Geothermal System

The geothermal system at the Round Mountain Mine is composed of a well system, piping, a heat exchanger system, and a reinjection well system. Hot geothermal waters are used in the south adsorption/desorption and refinery plant to heat leaching solutions during the winter months. Three geothermal production wells and one injection well exist at depths of approximately 1,000 to 1,600 feet below ground surface use submersible pumps to provide up to 3,000 gallons per minute of 180°F geothermal fluid. This fluid has a conductivity of 400 to 600 micromhos.

From the wells, geothermal fluid is pumped through a buried steel pipe to heat exchangers located approximately 5,000 feet away at the south adsorption/desorption and refinery building. Two

plate and frame heat exchangers transfer geothermal heat to the leach solution. The units are located over a concrete pad equipped with a drain to the barren pond.

After exiting the exchangers, the fluid is checked for increased conductivity, which would indicate the possible intrusion of high total dissolved solids leach solution. The signal from the conductivity instrument is relayed to the south plant programmable logic controller. If the reading is outside of the established normal operating range, an alarm sounds; the operator then adjusts the flows to the heat exchanger. From the heat exchangers, the geothermal fluid is piped downhill to two reinjection wells, where it is reintroduced to approximately the same geologic formation as the one from which it originated.

Typical flow rates for the geothermal fluid are 800 to 3,000 gallons per minute, depending on how many wells are in use. Typical leach solution flow rates are 5,000 to 11,000 gallons per minute, depending on plant flow rates and whether both heat exchanger units are on-line.

2.2.6.4 Employee Housing

The Hadley subdivision was developed on the former Christiansen Ranch Property by the SVCO during expansion of the mine in 1987. Hadley was developed to provide housing for mine employees and residents of the town of Round Mountain who chose to relocate. The subdivision contains both residential and commercial development; recreational amenities such as a library, tennis courts, golf course, and indoor pool; an elementary and a junior/senior high school. The population of Hadley as of April 1995 was estimated to be approximately 900 people.

2.2.7 Health and Human Safety

Although the mineral processing facilities use sodium cyanide and other potentially toxic materials, all of the processing components are designed to comply with a zero-discharge permit to surface or ground water. The adsorption/desorption and refinery plants are equipped with concrete flooring and curbing to contain and safely handle any spills of process fluids. All bulk storage vessels for liquid reagents and fuels on the mine site are constructed with a minimum of 110 percent lined containment volume of the largest storage vessel in that containment area.

2.2.8 Employment

Current employment at the Round Mountain Mine is approximately 540 people (April 1995). This represents approximately 40 percent of the mining employment in Nye County and over 5 percent of the total county employment. Most of the mine employees live in the Hadley subdivision, located 2 miles west of the project area.

2.2.9 Reclamation

Reclamation plans for the dedicated leaching facility and the general mine site were submitted to the regulatory agencies in 1992 and 1993, respectively. Approaches outlined in those plans are generally similar to the proposed reclamation of the tailings impoundment and mill site described in Section 2.3.6, Reclamation. The reclamation of affected areas with suitable slopes (overburden disposal areas, spent ore disposal areas, reusable leach pads, and ancillary facility areas) includes the application of approximately 10 inches of soil or suitable growth medium material followed by reseeding with a mixture of native and suitably adapted drought-tolerant grasses, forbs, and shrubs. The material on the dedicated leach pad would be regraded to reduce slopes to 3 horizontal to 1 vertical before application of the growth medium.

Project roads, except the pit road and main access road, will be reclaimed by ripping, covering with growth medium, and seeding.

Upon completion of mining, the open pit will be posted with warning signs, and a 5- to 8-foot-high rock berm will be placed across the pit access ramp and around the pit (RMGC 1995a).

2.2.10 Hazardous Material Use and Disposal

Non-hazardous solid waste generated on the site is disposed of in an Nevada Division of Environmental Protection-approved Class III on-site landfill. Septic wastes produced at ancillary facilities at the existing Round Mountain site are routed to various on-site septic systems.

The SVCO presently produces three waste streams that are not disposable in the Class III landfill. Stoddard solvent is distilled on the site, with the resultant sludges (less than 100 kilograms per month) shipped to a re-refiner. Waste motor oil

is produced at a rate of approximately 20,000 gallons per month and is recycled off the site. On-site assay wastes, consisting of slag, crucibles, and cupels, amount to less than 1 ton per month of non-hazardous waste. Hazardous waste generated at the Round Mountain site is transported by approved hazardous waste transporters to licensed recycling or disposal facilities.

2.2.11 Environmental Protection and Monitoring Programs

2.2.11.1 Air Emissions

Fugitive dust from traffic on roads at the Round Mountain Mine is controlled by regular watering with a dust control additive. Particulate matter generated at the south crusher is controlled by enclosures, baghouses, and water spray.

Ambient air quality at the Round Mountain site is monitored on a standard, federal, and state-approved cycle, and baghouses (on crushing facilities) are monitored routinely for opacity. In addition, meteorological stations at the site collect weather data continuously.

2.2.11.2 Surface and Ground Water

The existing mining and processing operations at the Round Mountain Mine are designed and operated to result in zero discharge to surface and ground water. The existing leach pads are lined with impermeable liners, as are the solution ponds. The tanks at the existing process plants are provided with secondary containment. Process solutions are monitored throughout the operation to detect any leakage.

There are no naturally occurring perennial surface waters present at the Round Mountain Mine or in the near vicinity downgradient from the proposed mill and tailing facility; therefore, surface water monitoring is not conducted. Geothermal ground water in the site vicinity is monitored to evaluate impacts, if any, of the reinjection system on the ambient ground water. Ground water monitoring beneath the mine and processing facilities is conducted in concurrence with the Nevada Division of Environmental Protection's Bureau of Mining Regulation and Reclamation.

2.2.11.3 Wildlife Protection

The existing process ponds and ditches associated with the dedicated and reusable leach pads contain potentially toxic levels of cyanide and are covered to exclude wildlife. The existing ponds and process plants are bermed and surrounded by 6-foot-high chain-link fences. In addition, the entire mine site is fenced with five strands of barbed wire to exclude livestock.

2.2.11.4 Erosion Control

During construction and operation, disturbed areas are watered as required to preclude wind erosion. To prevent sheet erosion, disturbed areas and reclaimed areas are ripped on the contour. Diversion ditches have been constructed to eliminate run-on from surrounding areas, as well as to control stormwater runoff from project areas.

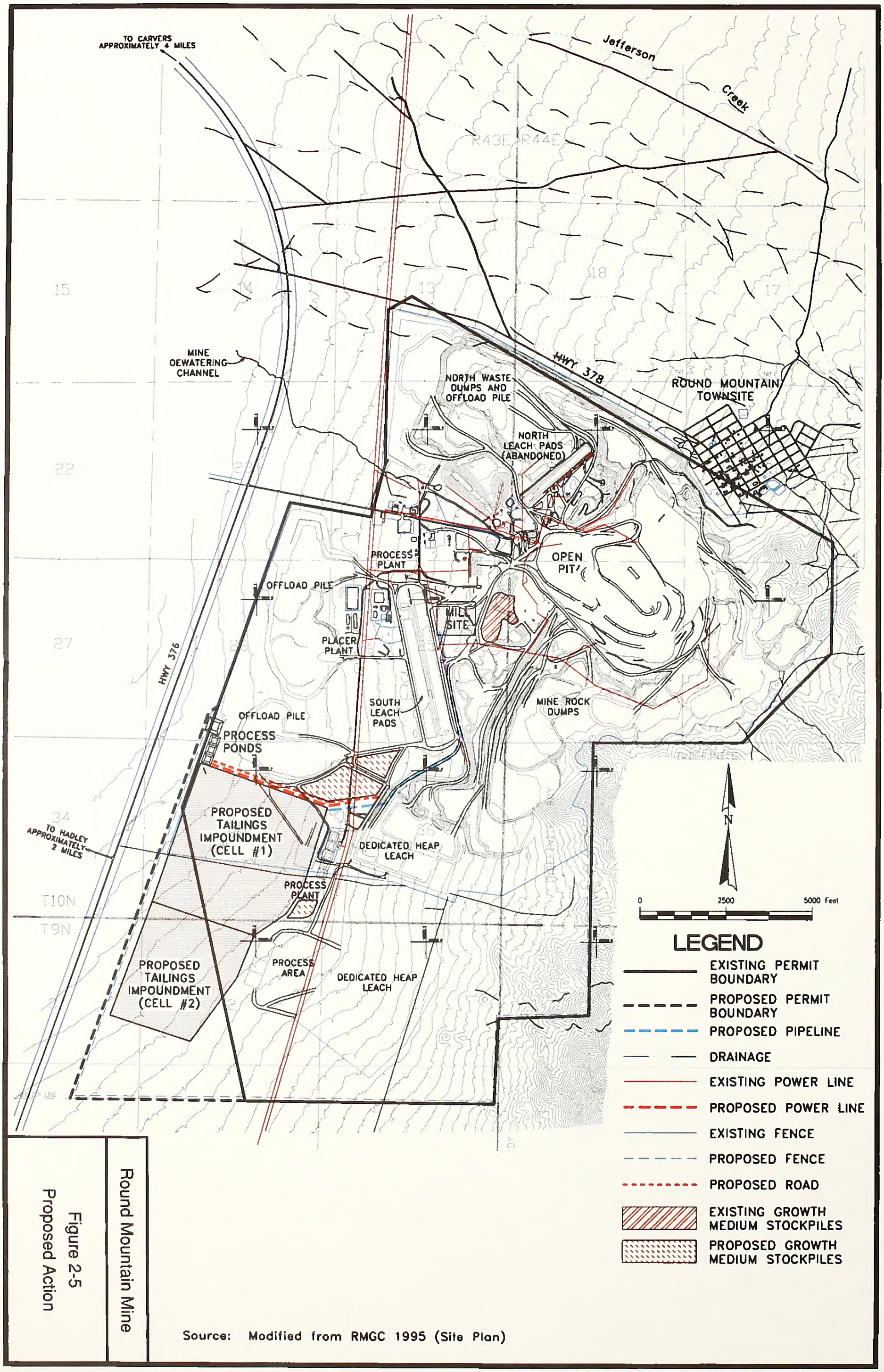
Haul and access roads are bladed and watered with a dust control additive as needed. Diversion ditches and road ditches are maintained. Drainage and diversion channels are maintained to manage runoff and run-on as the leach pad and overburden rock piles are expanded.

2.2.11.5 Visual Resources

The Round Mountain Mine is situated in a portion of the Big Smoky Valley classified for visual resources as a rehabilitation area. Both the existing and proposed operation at the Round Mountain Mine site would be seen from State Highways 376 and 378. Long-term visual effects will be minimized by reclamation measures, such as resloping and reseeding areas of disturbance.

2.3 Proposed Action

Activities comprising the proposed action for this environmental analysis are detailed in the *Plan of Operations* submitted to the BLM on May 4, 1995, as an amendment to the original *Plan of Operations* submitted to the BLM by the Round Mountain Gold Corporation in April 1987 for mining operations at the Round Mountain Mine. The proposed action ***(Figure 2-5)*** for this analysis includes constructing and operating additional gold processing facilities and associated infrastructure at the



Round Mountain Mine

Figure 2-5
Proposed Action

Source: Modified from RMGC 1995 (Site Plan)

existing Round Mountain Mine. The proposed action includes the following facilities:

(1) A gold mill to process up to 11,000 tons of unoxidized ore per day

(2) A new primary crusher rated at 11,000 tons per 8-hour day

(3) A tailings impoundment that would ultimately accommodate approximately 57 million tons of mill tailings and would cover approximately 615 acres

(4) An ore stockpile for the mill feed

(5) Five miles of new power lines to accommodate power distribution requirements

(6) A cyanide destruction system to maintain non-toxic levels of weak acid dissociable cyanide in the tailings impoundment

(7) Tailings delivery pipelines for transporting tailings from the mill to the impoundment

(8) A reclaim water pipeline to return reclaim water from the impoundment to the mill

(9) A water pipeline to supply fresh water to the mill

(10) A septic system to support the mill

(11) One mile of new access/haul road

(12) Growth medium stockpiles

Table 2-3 presents the additional surface disturbance associated with the proposed modification and expansion of the mine facilities. Surface disturbance is presented for the life of the project (12 years).

The proposed mill and tailings facility are needed to improve the recovery of gold from unoxidized ores that are being mined from the existing open pit. No changes to the development and operation of the permitted open pit and associated overburden rock piles are proposed by this action. Mining and overburden rock disposal will continue as described in previous plans of operations approved by the BLM, Nevada Division of Environmental Protection, and Forest Service.

Table 2-3
Estimated Surface Disturbance

Component	Acres Disturbed
Primary Crusher, Mill, Ore Stockpiles, Septic System	50
Tailings Impoundment and Storm Water Diversion Structures	615
Freshwater, Tailings Delivery, and Reclaim Water Pipelines	2
Process Ponds	10
Access/Haul Road	1
Power Line Spurs	5
Growth Medium Stockpiles	74
TOTAL	757[1]

[1] Ultimately, the proposed facilities would result in approximately 757 acres of surface disturbance, 250 acres of which would occur on lands outside of the existing permit boundary.

In addition to addressing the anticipated environmental effects of the proposed action, this EIS also addresses components of the existing operations that have not previously been subject to environmental analysis, i.e., environmental issues associated with pit dewatering and pit water quality and the effect on ground water from the present disposal of leached ore from the reusable leach pads.

2.3.1 Crushing and Milling Operations

The proposed crushing and milling circuit is shown schematically in ***Figure 2-6***. The mill facility would require pit run-of-mine ore to be crushed to less than 6 inches before being fed to the milling equipment. This would be accomplished by a primary crushing facility consisting of the following equipment: a dump pocket for receiving run-of-mine ore, an apron feeder to transport ore at a controlled rate to the crusher, a primary gyratory crusher, conveyor belts to transport crushed ore from the crusher, a radial stacker discharging to a crushed ore stockpile, and variable speed apron feeders under the stockpile to feed crushed ore to the mill via a conveyor.

Particulate matter emissions at the various transfer points in the crusher system would be controlled by baghouses augmented by water or fogging sprays where baghouse control is not practical. Sprays would be located at the run-of-mine dump pocket and the discharge point of the stationary

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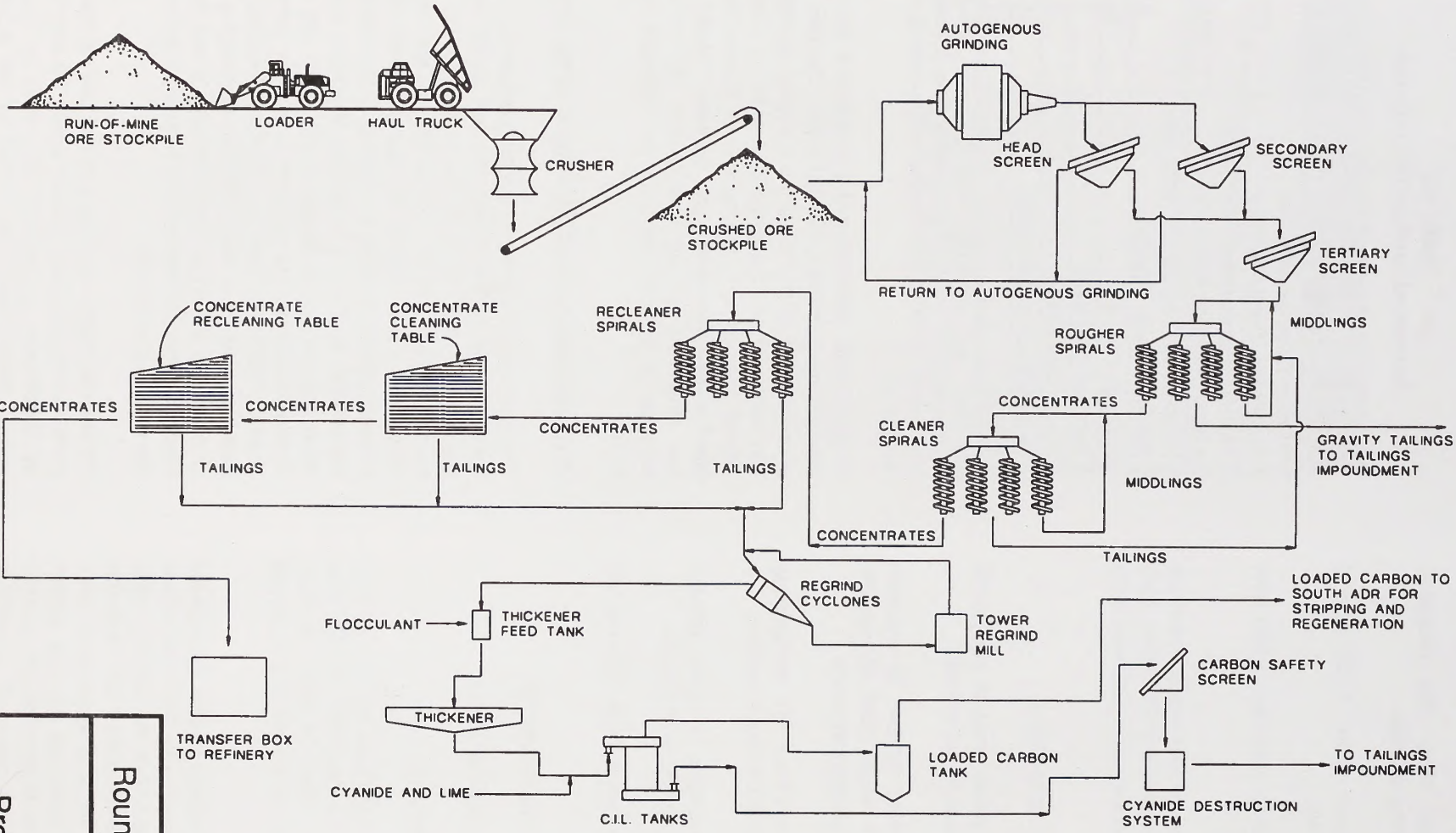


Round Mountain Mine

Figure 2-6
Proposed Mineral Processing Circuit

Source: RMGC 1995

stacker. The proposed mill and tailings facility would be permitted through the Nevada Division of Environmental Protection's Bureau of Air Quality.

The mill circuit would consist of an autogenous grinding mill capable of semi-autogenous operation, screens, spiral concentrators, cleaning tables, thickeners, a regrind mill, carbon-in-leach agitated leaching tanks, reagent handling, and a cyanide neutralization circuit. Other gravity separation equipment may be added or substituted to improve recovery. The equipment would be used to separate the gold-containing concentrates from the bulk of the ore, preventing the majority (90 percent to 95 percent) of the ore from contacting cyanide solution. Free gold separated from the concentrate by the cleaning tables would be sent directly to the refinery (***Figure 2-6***).

The gravity concentrate would be reground and agitation leached with cyanide to extract the gold and silver values. Activated carbon in the agitated leach circuit would adsorb the precious metals as they are liberated from the leach slurry. The carbon would be screened from the slurry and sent, along with free gold concentrate, to the south adsorption/desorption and refinery plant for recovery of the precious metals and regeneration of the activated carbon.

The leach circuit tailings would pass through the cyanide neutralization circuit and would be combined with the gravity circuit tailings and sent to the tailings impoundment. The combined flow rate to the tailings impoundment would be 11,000 tons per day, dry basis. The tailings would be in a slurry form with a solids concentration of approximately 29 to 49 percent by weight.

An INCO process cyanide neutralization system would be installed in the carbon-in-leach tailings circuit to ensure that cyanide in the barren tailings solution is destroyed and would not be lethal to wildlife. The INCO process at the SVCO would use ammonium bisulfite, rather than sulfur dioxide, to destroy cyanide compounds in the agitated tailings slurry.

The proposed mill building and tank retaining walls would provide 110 percent containment of the largest component in the event of a sudden draindown of the process components; curbing, drains, and sump pumps would recirculate spilled process solutions back to the mill circuit.

2.3.2 Tailings Facility

The proposed tailings impoundment ***(Figure 2-5)*** would include a composite liner system consisting of a 60-mil (0.001-inch) thick high density polyethylene liner. The subgrade beneath the synthetic liner would be composed of 12 inches of soils compacted to a permeability rating of 1×10^{-6} centimeters/second. The SVCO proposes to use neutralized leach offload material to construct the compacted subgrade.

Fluids from the deposited tailings would drain through corrugated, perforated polyethylene piping, which would be placed on top of the primary liner. The entire underdrain system and primary liner would be covered with an underdrain blanket (18 to 36 inches deep) composed of a leach offload material or selected native soil materials.

In April 1991, a sampling and analysis program was undertaken to characterize the overburden and leach offload material (WESTEC 1991). In October 1992, a sampling, analysis, and hydrogeologic program was undertaken to further characterize the offloaded leached ore residue material and any potential to affect the hydrogeologic system surrounding the Round Mountain site (Hydro-Search, Inc. 1993). The results of these studies and the potential impacts of these activities are discussed in Section 3.1, Water Quality and Quantity.

Available analytical data from the Hydro-Search, Inc. study indicate that using a 1-foot layer of leached offload material as leach pad subbase would not pose an environmental threat to waters of the state (see the analysis of the leach offload piles in Section 3.2.2.1). Based on the results of that study, the SVCO plans to use leach offload material to construct the tailings impoundment subbase, following Nevada Division of Environmental Protection approval. The 12-inch-thick compacted layer directly beneath the 60-mil high density polyethylene liner would be placed over a natural soil subgrade that has been scarified and recompacted. The proposed liner system exceeds Nevada Division of Environmental Protection's minimum design criteria for tailings facilities (Nevada Administrative Code 445.24368).

In the proposed tailings impoundment, tailings would drain and consolidate, permitting the reuse

of process water. It is estimated that of the total water used in the milling process, 82 percent would be reclaimed from the tailings facility. An estimated 18 percent (approximately 880 gallons per minute) of the water would be lost through a combination of evaporation from the tailings impoundment, evaporation from the solution collection ponds, and interstitial entrapment within the tailings material stored in the facility. This water lost in the circuit would be replenished by water supplied from existing permitted wells. The tailings impoundment would be equipped with a peripheral tailings line that would rest inside the embankment crest. The spigotting of tailings from the peripheral line would control deposition within the impoundment, allowing the solution to be decanted and returned to the mill. Because of the fine grind required to liberate gold from the concentrate and the clay content of the ore, the slope of the solid material in the tailings facility is expected to be relatively shallow. In addition, the fine material and clay slimes are expected to seal off adjacent layers and inhibit vertical movement of the solution. Consequently, the reclaim solution would be pumped from a decant pool in the tailings facility, rather than relying on the underdrain system.

The purpose of incorporating the underdrain system into the tailings impoundment design is to reduce the hydraulic head on the 60-mil high density polyethylene liner to allow the tailings mass to consolidate and drain. A series of corrugated, perforated polyethylene pipes encased in the underdrain blanket would be laid across the top of the polyethylene liner at specified intervals. These pipes would gravity drain tailings fluids to the two collection ponds below the tailings dam, where the solution would be pumped back to the mill circuit. Under initial operating conditions, the majority of the reclaim solution would report to the underdrain system. However, soon after startup this underdrainage is expected to decrease because fine grind and clayey fractions would partially seal the lower layers of the facility. The underdrain would, however, continue to minimize the hydraulic head on the liner. Conventional tailings fluid reclaim procedures would then be implemented as the permanent decant system becomes operational.

Four ponds would be constructed adjacent to the northwest corner of the tailings pond. The two collection ponds for the underdrain system and the sediment pond would be double lined using primary (60-mil) and secondary (40-mil) high density polyethylene liners and equipped with leak detection, collection, and monitoring systems. The layer of geonet placed between the primary and secondary liners would serve as a leak detection/collection layer. The layer would convey any excursions of process solution between the liners to a gravel-filled leak detection/collection sump. Pipes extending from the leak detection/collection sump to the edge of the liner would allow the inspection of any fluid accumulation in the sump and the extraction of fluids from the sump. The emergency storm pond would have a single liner.

Three above-ground pipelines would be constructed as part of the proposed project. Two lines, one as a standby line, would carry tailings to the impoundment, while the third would return reclaim water to the mill. The pipelines would be routed around the south end of the reusable leach pads to the proposed tailings disposal facility, a length of approximately 12,000 feet, with an additional estimated 5,500 feet of peripheral distribution line at the tailings facility. To the extent possible, the three lines would be laid together to keep surface disturbance to a minimum. The tailings delivery and reclaim water pipelines would be located in a ditch to control potential spills or leaks. The approximate routes of the pipelines are shown in ***Figure 2-5***.

2.3.3 Ancillary Facilities

2.3.3.1 Water Supply and Fresh Water Pipeline

Fresh water for the proposed milling facility would be obtained from the existing fresh water supply system at the mine. The SVCO proposes to construct a buried freshwater pipeline approximately 500 feet long to the mill facility.

2.3.3.2 Sanitary Waste

A septic system would be constructed to service the proposed mill facility. The system would be designed to meet the requirements of the Nevada Division of Health Protection Services. No hazardous waste would be disposed of in this system.

2.3.3.3 Mill Building and Chemical Storage Area

The proposed mill would be located adjacent to and south of the secondary crusher building (***Figure 2-5***). Pursuant to Nevada Administrative Code 445.24366, the mill would be equipped with sufficient secondary containment to accommodate 110 percent of the largest tank within the area.

Cyanide and reagents for the cyanide neutralization circuit would be stored at the mill. Caustic would not be stored at the new mill, but would be stored for use as needed at the existing adsorption/desorption and refinery plant. The mill would use pH-stabilized liquid cyanide that would be stored outdoors in tanks designed for storing this reagent. The cyanide tanks would be placed in a concrete containment area designed to contain 110 percent of the volume of the largest tank. The pH-stabilized liquid cyanide would be pumped directly from tank trucks into the storage tanks. Strict operating procedures, including constant monitoring, would be followed at all times while offloading and filling the liquid cyanide tanks to minimize any risks of spills.

2.3.3.4 Stormwater Diversion

Runoff from the upgradient watershed would be directed around the tailings facility. This runoff would be diverted around the tailings impoundment by the existing dedicated leach pad and its associated diversion ditch. No other diversion ditches are planned at this time. The existing diversion ditch is designed to channel the 100-year, 24-hour storm event.

Placing the tailings impoundment downgradient of the dedicated leach pad would locate the impoundment in a protected position, away from stormwater runoff originating upgradient of the mine site. A diversion ditch would divert potential runoff from Kelsey Canyon to the south or north, until overburden piles reach full length along the east side of the dedicated pad.

Runoff diverted to the north would flow around the north end of the dedicated pad to sedimentation/infiltration structures north of the tailings facility. Runoff diverted to the south would be discharged across an energy dissipation structure south of the dedicated pad. After the overburden piles have been built to their full length along the east side of the dedicated pad, all runoff from Kelsey Canyon would be diverted to the south.

2.3.3.5 Electricity

The new 24.9-kv power line to the mill ***(Figure 2-5)*** would extend from the existing 230-kv substation located northwest of the south processing plant. A short spur from the existing power line would extend to the ponds at the tailings impoundment. The total area of disturbance for both power line spurs would be 5 acres.

2.3.4 Employment

The construction of the proposed mill and tailings facility is scheduled to begin in 1996 and is expected to last approximately 1 year. This construction would partially coincide with the expansion of the approved dedicated leach pad. The SVCO anticipates that a total peak work force of approximately 305 would be needed to construct the mill and tailings facility (200 workers) and to expand the dedicated leach pad (105 workers).

The proposed milling operation is scheduled to begin shortly after construction is completed and would continue until 2008. The SVCO estimates that 43 people would be required to operate the proposed mill and tailings facility, including related activities such as maintenance. Currently, the SVCO employs approximately 540 people (April 1995). This figure is a reduction from approximately 600 people in 1992.

2.3.5 Elementary School Relocation

The SVCO has relocated the elementary school from the existing location at Round Mountain to a new location adjacent to the high school at Hadley. The SVCO was responsible for site preparation, water and sanitary waste facilities, and the provision of one module for the new school building. Additional information on schools is provided in Section 3.12, Social and Economic Values.

2.3.6 Reclamation

2.3.6.1 Postmining Land Use

The proposed postmining land use of the project area would be similar to the premining operation land use in that the primary land uses would continue to be livestock and wildlife habitat. Additional mineral exploration and mining activities are anticipated to occur in the vicinity until the mineral reserves associated with the ore body are exhausted. Reclamation and revegetation would commence upon the final deactivation of specific exploration or mining activities. The establishment of self-sustaining vegetation communities on reclaimed sites would assist in reducing the

erosion potential of these areas and restoring the forage production capability.

Revegetation of the reclaimed sites within the project area would be accomplished through a combination of seeding and natural re-invasion of native vegetation. Proper growth medium management would also facilitate successful revegetation of the site. All reclamation must meet or exceed the standards as stated in *Attachment B* of the *Nevada Interim Standards for Successful Reclamation.*

2.3.6.2 Growth Medium Management

Where practicable, all available growth medium would be salvaged from the areas scheduled for disturbance, as shown in ***Table 3-13***. The salvaged growth medium would be stockpiled at the locations shown in ***Figure 2-5***. The stockpiles would be constructed to facilitate soil rehandling by either self-propelled scrapers or front-end loaders and dump trucks. All the stockpiles would be identified by signs to ensure that they are not used for purposes other than reclamation. The soil stockpiles would be seeded with the reclamation mix to reduce potential short-term erosion.

The majority of salvageable soil at the proposed project site is composed primarily of a gravelly coarse sandy loam soil material. This soil is similar in composition to the finer alluvial overburden material removed from the open pit and deposited on the overburden dumps. The SVCO proposes using alluvial material from the pit as an additional growth medium to supplement the available soil materials.

Based on an evaluation of soil depths conducted at the site, the SVCO estimates that the depths of soil material listed in ***Table 3-13*** of the Soils and Watershed section would be stripped from planned areas of disturbance and stockpiled for reclamation purposes. ***Table 2-4*** lists the estimated amount of salvageable soil material and the amount required for reclamation. By using 18 inches of growth medium on the surface of the tailings impoundment, a shortfall of approximately 387,804 cubic yards would occur. This balance would be made up using pit alluvium, which has proven suitable as growth medium.

2.3.6.3 Seed Mix

Table 2-5 lists the proposed plant species and application rates for the project site reclamation seed mix. The mix was developed by the SVCO in conjunction with WESTEC (RMGC 1995) and the BLM based on site-specific conditions, including annual precipitation and soil pH. Baseline information gathered from established test plots was also considered by the SVCO during seed mix development. The seed mix was designed to provide a diversity of primarily native species that would stabilize the reclaimed facilities and assist in achieving the postmining land use objectives. These species are drought and alkali tolerant and would provide palatable forage for livestock and wildlife. The species in the mix were also selected for their ability to establish viable plant communities on the reclaimed slopes, which will have soil textures ranging from coarse, well-drained materials to silty sand materials.

TABLE 2-4
Growth Medium Volumes

Facility	Acres	Cubic Yards Salvaged Based on Available Suitable Soil Material	Cubic Yards Required for Reclamation[1]
Tailings Impoundment & Dam Faces	615	974,454	1,380,180
Mill Site	50	80,667	66,393
Haul Roads	1	1,613	1,344
Pipeline	2	645	2,678
Transmission Line Spurs	5	6,131	6,695
Process Ponds	10	20,167	13,991
Growth Medium Stockpiles	74	0[2]	0
TOTAL	757	1,083,677	1,471,481[3]

[1] Values determined by applying 18 inches of growth medium to the impoundment area (515 acres); 10 inches to the dam faces (100 acres); 10 inches to the reclaimed haul road surface; and 10 inches to the pipeline, mill site, transmission line spurs, and process ponds.
[2] Soil would not be salvaged beneath the growth medium stockpiles.
[3] The additional growth medium (approximately 387,804 cubic yards) would be composed of pit alluvium.

TABLE 2-5
Reclamation Seed Mix

Species	Drill Seed Rate (pounds pure live seed per acre)	Drill Seed Rate (number of pure live seeds per square foot)
Thickspike wheatgrass *(Agropyron dasystachyum)*	0.73	2.60
Streambank wheatgrass *(Agropyron riparium)*	1.02	4.00
Great Basin wildrye *(Elymus cinereus)*	0.73	2.10
Crested wheatgrass *(Agropyron cristatum)* var. Fairway	0.36	2.10
Galleta *(Hilaria jamesii)*	0.34	1.30
Canby bluegrass *(Poa canbyi)*	0.02	2.80
Indian ricegrass *(Oryzopsis hymenoides)* var. Paloma	0.77	2.80
Bottlebrush squirreltail *(Sitanion hystrix)*	0.57	2.80
Western yarrow *(Achillea millefolium)*	0.01	0.64
Palmer penstemon *(Pensteman palmeri)*	0.25	0.46
Blue Flax *(Linum lewisii)*	0.04	0.46
Desert globemallow *(Sphaeralcea ambigua)*	0.04	0.46
Fourwing saltbush *(Atriplex canescens)*	2.18	2.80
Shadscale *(Atriplex confertifolia)*	0.04	1.50
Rubber rabbitbrush *(Chrysathamnus nauseaosus)*	0.25	2.0
Bitterbrush *(Purshia tridentata)*	0.25	1.00
Desert snowberry *(Symphoricarpus longiflorus)*	0.04	1.00
Plateau gooseberry *(Ribes velutinum)*	0.25	0.64
Winterfat *(Ceratoides lanata)*	0.25	1.00
TOTALS	**13.63**	**38.40**

Source: RMGC 1995

Potential alternative plant species to the proposed reclamation seed mix may include the following: firecracker penstemon (*Penstemon eatonii*), spiny hopsage (*Grayia spinosa*), scarlet globemallow (*Sphaeralcea ambigua*), and prostrate kochia (*Kochia prostrata*). The proposed seed mix and seeding rates for drill application would provide approximately 14 pounds per acre.

The proposed application rate should allow adequate vegetation establishment within the average annual moisture regime (approximately 8

inches of precipitation). The individual species in the mix and the application rate would be altered, if necessary, based on the continued evaluation of seeded sites and seed availability.

2.3.6.4 Seeding Techniques

Most of the seeding would be accomplished with a drill during the fall or early spring planting season. Broadcast methods may be used on selected areas. The drill seed application rate listed above would be doubled for broadcast seeding. Site conditions would determine the optimum seeding window.

2.3.6.5 Soil Amendments

The vegetation test plots and concurrent reclaimed sites would be evaluated to determine the revegetation potential of resoiled sites. The SVCO would conduct nutrient analyses of the soil materials to be used for growth medium. Based on these analytical results, fertilizers may be applied to selected sites on an as-needed basis. Any application of fertilizers would be timed to optimize existing and anticipated soil moisture, which would maximize nutrient uptake by the vegetation. Depending on the type selected, fertilizers would be applied to the sites in the fall season before or during seeding, or in the spring before the onset of plant growth.

2.3.6.6 Postmining Topography

The proposed mill site, including the ore stockpile, would be constructed on a gently sloping alluvial fan. Once all equipment and structural facilities have been removed, the mill site would be covered with sufficient overburden material and shaped to allow drainage and blending with the adjacent topography.

In order to maintain long-term stability, the tailings impoundment would remain at its designed configuration. Roads and the tailings pipeline ditch would be regraded and backfilled to blend with the adjacent terrain.

2.3.6.7 Tailings Impoundment Reclamation

To prevent ponding, a 5-foot freeboard of dam crest would be bulldozed inward and onto the final tailings surface. The impoundment design and the proposed tailings deposition would be such that additional waste rock would not be required to achieve the final free draining tailings. The consolidated tailings surface would be covered with 18 inches of growth medium that would be scarified and revegetated. In addition to providing a free draining surface, the proposed reclamation would create a rock and soil cap to reduce the potential for meteoric waters to infiltrate the consolidated tailings.

2.3.6.8 Tailings Collection and Maintenance Ponds

Any sludge remaining in the collection ponds would be sampled and analyzed. If the results indicate the sludge does not have the potential to degrade waters of the state, the sludge would be buried in place with the pond liners. If the pond sludge has the potential to degrade waters of the state, the material would be returned to the lined tailings impoundment for final disposal, pending Nevada Division of Environmental Protection approval, or it would be properly disposed of off the site. The pond sites would be backfilled and regraded to prevent ponding, and would be covered with approximately 18 inches of growth medium, scarified for seedbed preparation, and revegetated.

2.3.6.9 Tailings Pipeline Reclamation

The pipes associated with the tailing distribution system would be flushed with fresh water for detoxification. The pipe would then be sold as salvage or disposed of in an approved manner. The associated containment ditch would be backfilled and graded to blend with the adjacent topography, and revegetation would be conducted as outlined above.

2.3.6.10 Roadway Reclamation

The existing haul road to the S-3 leach offload pile would be used to access the proposed tailings facility. Approximately 1 acre of new haul road would be constructed for the mill and tailings facilities. The constructed roads would be designed to carry the maximum weight range of the vehicles or equipment, including 190-ton haul trucks. Reclamation of these roads would consist of ripping, resoiling, regrading, and revegetation. All berms, sidecast material, and road drainage ditches would be reclaimed in this process. The relatively flat topography of the project area minimizes the need for cut-and-fill road construction.

Reclamation would be accomplished using appropriate equipment, including crawler-type tractors. Where necessary, driving surfaces would be ripped to depths of 12 to 18 inches to fracture hard-packed soil material. The roadways would be covered with soil or alluvial material to an average 10-inch depth. Revegetation would be conducted as outlined above.

Where possible, drainages that were altered by the construction of the project road system would be reconstructed to facilitate drainage. Any culverts would be removed unless the BLM requests that they be left in place.

It is possible that ripped road-bed material would be used for seedbed without adding growth medium. If this occurs, the road bed material would be analyzed for available nutrients. Appropriate soil amendments would be applied as needed.

Upon completion of all reclamation activities, the SVCO would ensure that adequate public access has been restored to BLM-administered public lands. Access restoration would be coordinated with the BLM, as necessary.

2.3.6.11 Disposal of Mill Facilities and Equipment

All salvageable materials, such as building materials, transformers, pumps, generators, and miscellaneous machinery, would be removed and used off the site. Machinery and materials without salvage value would be disposed of according to federal and state regulations. Any non-hazardous or non-toxic materials, such as scrap lumber or metal, would be disposed of in a state-approved Class III landfill.

Reagents, petroleum products, solvents, and other hazardous or toxic materials would be disposed of according to federal and state regulations.

All equipment that contained process solutions, including pumps, piping, leach tanks, and carbon adsorption facilities, would be neutralized and disposed of according to federal and state regulations. The neutralization could include rinsing with fresh water, rinsing with a diluted oxidizing reagent, ultraviolet degradation, or a combination thereof.

The septic system/leach field would be managed and closed according to state regulations.

All structural materials would be removed and foundations would either be flattened or broken up and disposed of on the site. The mill site would then be covered with suitable waste rock or overburden and regraded to provide drainage and blend with the existing topography. The site would be covered with a minimum of 10 inches of growth medium, scarified, and revegetated.

2.3.7 Environmental Protection and Monitoring Programs

2.3.7.1 Air Emissions

Fugitive dust from traffic on additional roads at the Round Mountain Mine would be controlled by regular watering and a dust control additive. Particulate matter generated at the proposed crusher facility would be controlled by enclosures, baghouses, and water spray.

Ambient air quality at the Round Mountain site is monitored on a 6-day schedule, and baghouses (on crushing facilities) are monitored routinely for opacity. In addition, meteorological stations to the north and south of the site collect weather data continuously.

2.3.7.2 Surface and Ground Water

The proposed facilities would be designed and operated to result in zero discharge to surface and ground water. The tailings impoundment and associated ponds would be lined with impermeable liners. The chemical storage area at the mill would be provided with secondary containment large enough to contain 110 percent of the largest storage tank.

In the absence of naturally occurring perennial surface waters downgradient from and near the proposed operations, surface water monitoring is not proposed. Ground water monitoring beneath the mine and processing facilities is conducted in concurrence with the Nevada Division of Environmental Protection's Bureau of Mining Regulation and Reclamation.

2.3.7.3 Wildlife Protection

Tailings discharged to the proposed impoundment would be neutralized to prevent cyanide toxicity to wildlife. The impoundment and reclaim ponds would be fenced with a 6-foot chain link fence

topped with an additional 2 feet of barbed wire to exclude large wildlife species and livestock.

The open pit would be fenced with an 8-foot chain link security fence topped with 2 additional feet of barbed wire. The pit access ramp would be blasted following the completion of the pit lake monitoring required by the Nevada Division of Environmental Protection.

2.3.7.4 Erosion Control

Several measures similar to those used at the existing operations would be employed to reduce or eliminate erosion on disturbed areas during construction and operation.

During construction and operation, disturbed areas would be watered as required to preclude wind erosion. Disturbed areas and reclaimed areas would be ripped on the contour to prevent sheet erosion. Diversion ditches would be constructed and maintained to eliminate run-on from surrounding areas, as well as to control stormwater runoff from project areas.

2.3.7.5 Visual Resources

The Round Mountain Mine is situated in a portion of the Big Smoky Valley classified for visual resources as a rehabilitation area. The proposed facilities would be visible from State Routes 376 and 378. Long-term visual effects would be minimized by reclamation measures, such as resloping and reseeding areas of disturbance.

2.4 Project Alternatives

Alternatives to the proposed action include a range management alternative that would mitigate some anticipated impacts of the proposed action, a siting alternative for the tailings impoundment and process pond complex, and the no action alternative under which the proposed mill and tailings impoundment would not be built. These alternatives are described and compared in the following sections.

The alternatives considered but eliminated, as well as the reasons for their elimination, are described in Section 2.4.2, Alternatives Eliminated from Detailed Analysis.

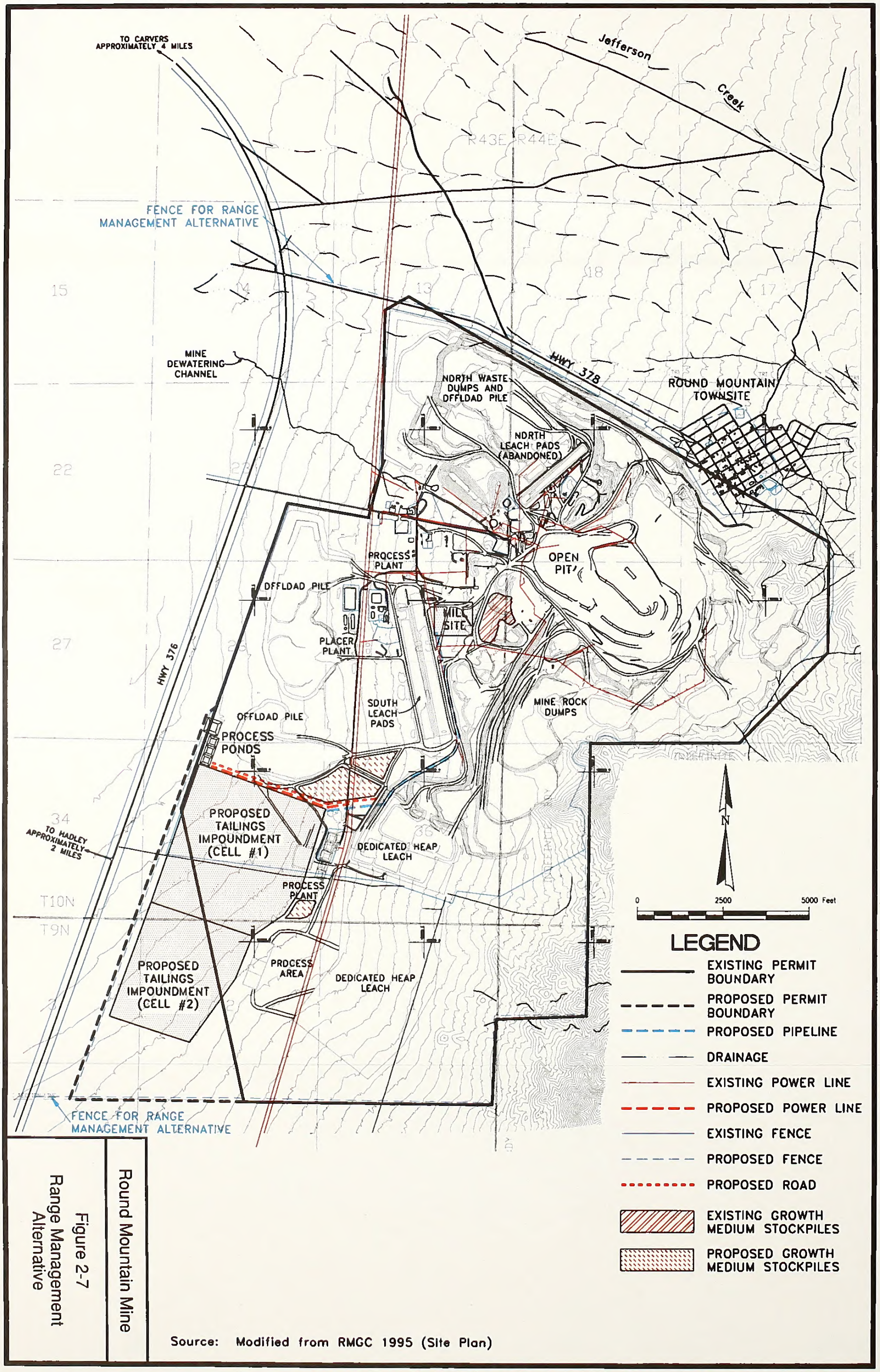
2.4.1 Alternatives Considered in Detail

2.4.1.1 Range Management Alternative

The proposed project would include constricting the existing grazing corridor between State Highway 376 and the Round Mountain Mine from the current 1,200-foot width to approximately 1,000 feet. This constriction and the extension of the corridor farther to the southwest to encompass the proposed tailings impoundment site in Sections 2 and 3, T9N, R43E, are expected to accentuate the existing situation of over-grazing and trampling in the corridor from livestock moving to and from the water supply provided by the mine dewatering discharge to the north.

The range management alternative, which would be applicable only in combination with the proposed action, would address the current serious and potentially severe over-grazing situation in the corridor by fencing across the corridor and converting it from open pasture to a stock driveway for the duration of mining and reclamation activities (***Figure 2-7***). Along with fencing the south end of the corridor on the project boundary and extending it to the State Highway 376 fence, a fence would also be constructed at the north end of the corridor. This fence would run along the north side of State Highway 378 from the State Highway 376 fence around the north side of the Round Mountain townsite to the current northeast project boundary fence to prevent livestock access to the corridor around the mine dewatering channel. A cattle guard would be placed across the county road to the dump and across Jefferson Canyon and Shoshone Canyon roads. Fences and cattle guards for this alternative would be provided and installed by the SVCO.

Livestock in the Smoky Allotment would be dependent on water sources other than the current mine dewatering flow. The nearest current perennial water source is approximately 6 miles north of the mine at Jakes Well in Section 24, T11N, R43E. The SVCO would install a 10,000-gallon tank approximately 3 miles north of the mine in SWSE Section 36, T11N, R43E to provide an additional water source for the livestock. Livestock use in this location would be monitored by BLM use pattern mapping techniques to detect and prevent overgrazing. RO livestock would not be



Round Mountain Mine

Figure 2-7
Range Management Alternative

Source: Modified from RMGC 1995 (Site Plan)

allowed to access this haul water location if use pattern mapping indicated the development of moderate or high levels of use (overgrazing). An additional tank would be installed by the RO Ranch at a new location south of the mine in SESW Section 23, T9N, R43E. The existing tank near the south end of the corridor area in Section 10, T9N, R43E would be left in place, but used only a few days each year as livestock are moved through the corridor. The RO Ranch would be responsible for hauling water to the new tanks to water livestock on an as-needed basis during its grazing period from November 1 through June 30.

Appropriate cultural resource clearance surveys and mitigation, if necessary, would be conducted for the fencing and water haul sites prior to installation of these improvements. This alternative would include a realignment of the boundary between the Smoky Allotment and the San Antone Allotment to coincide with the southern boundary of the mine permit area. Appropriate adjustments would be made to redistribute animal unit months between the allotments while maintaining the current allowable usage for each permittee.

2.4.1.2 Tailings Impoundment Alternative

The SVCO evaluated alternative tailings facility locations during feasibility studies for the proposed mill and tailings impoundment. The BLM selected one of these alternative locations for analysis in the EIS.

The alternative tailings impoundment would be located north of the existing mine in Sections 7 and 18, T10N, R44E; and Section 13, T10N, R43E (***Figure 2-8***). The impoundment would be located immediately north of State Highway 378 between State Highway 376 and the Round Mountain townsite.

The engineering and design of the facility at this location would be similar to the proposed action; however, this alternative would require pumping the tailings from the mill to the impoundment. The addition of the pumps and the increased length of pipeline to the tailings impoundment would complicate the transport of the tails, and thus the likelihood of a spill would be increased.

The tailings facility would require the construction of new fresh water and reclaim pipelines, power lines, and roads, as indicated in ***Figure 2-8***. Placing the tailings impoundment north of the highway would create additional disturbance from constructing diversion ditches to capture and divert surface runoff around the facility. The approximate disturbance area of the alternative tailings impoundment, process ponds, and pipelines would be 452 acres. Of this total, approximately 13 acres would be within the existing approved permit area and 439 acres would be outside of this area.

The range management alternative would not be applicable in combination with this alternative.

2.4.1.3 No Action Alternative

This alternative would involve the continued operation of the Round Mountain Mine with the existing facilities; however, the construction and operation of the proposed mill and tailings facilities would not occur. Under this alternative, the gold recovery from unoxidized ores would remain at approximately 36 percent, resulting in inefficient operation when compared to the expected recovery level of approximately 85 percent with the proposed mill. As the unoxidized ores become more prevalent with increasing pit depth, this alternative would lead to progressively lower overall operating efficiencies.

2.4.2 Alternatives Eliminated from Detailed Analysis

2.4.2.1 Alternative Tailings Impoundment Locations

The BLM and the SVCO have examined a number of alternative tailings impoundment locations near the existing operations. These alternative tailings impoundment sites include a location near Hadley, approximately 2 miles west of the proposed tailings site, and a location adjacent to the east side of State Highway 376 between the mine access road and State Highway 378. The SVCO also examined multiple configurations and designs for the tailings impoundment at the proposed location. These alternatives are not considered likely to mitigate the anticipated environmental effects associated with the proposed action. Therefore, these alternatives were not examined in detail.

2.4.2.2 Pit Backfill Alternative

Upon completion of mining at the Round Mountain Mine, ground water will flow into the existing open

pit resulting in the formation of a pit lake; the final pit lake elevation is predicted to be 5,528[1] feet with a surface area of 155 acres and a maximum depth of 323 feet (Hydro-Search, Inc. 1994c).

This alternative would involve partial backfill of the open pit to eliminate the pit lake. Backfilling the pit would eliminate water loss caused by evaporation; therefore, the ground water elevation in the pit area would rise to approximately the pre-mining ground water level. In order to eliminate the pit lake, it would be necessary to backfill the pit up to an average elevation of 5,900 to 6,000[1] feet.

Approximately 266.9 million cubic yards (360 million tons) of material would be required to backfill the pit to an elevation of 6,000 feet. Based on the mine plan and the associated pit configuration, backfilling could not commence until the completion of mining; therefore, the backfilled material would be hauled from one of the waste rock disposal areas (RMGC 1995b). The backfill operation would occur over a 5-year period and would require approximately 116 mine production workers in addition to other personnel (RMGC 1995b). The estimated equipment and general personnel requirements are summarized in ***Table 2-6.***

Backfilling the pit is not considered economically feasible because it would increase mining costs from approximately $0.54 per ton to $0.74 per ton for a total additional cost of approximately $117 million. This significant increase in mining costs (approximately 37 percent) would reduce the amount of gold that is economically recoverable by approximately 1.45 million ounces, thus reducing the size of the pit and the duration of mining. Because these combined economic factors make the alternative infeasible, backfilling the pit has been eliminated from consideration and the environmental impacts have not been evaluated in detail in the EIS.

2.5 Past, Present, and Reasonably Foreseeable Future Actions

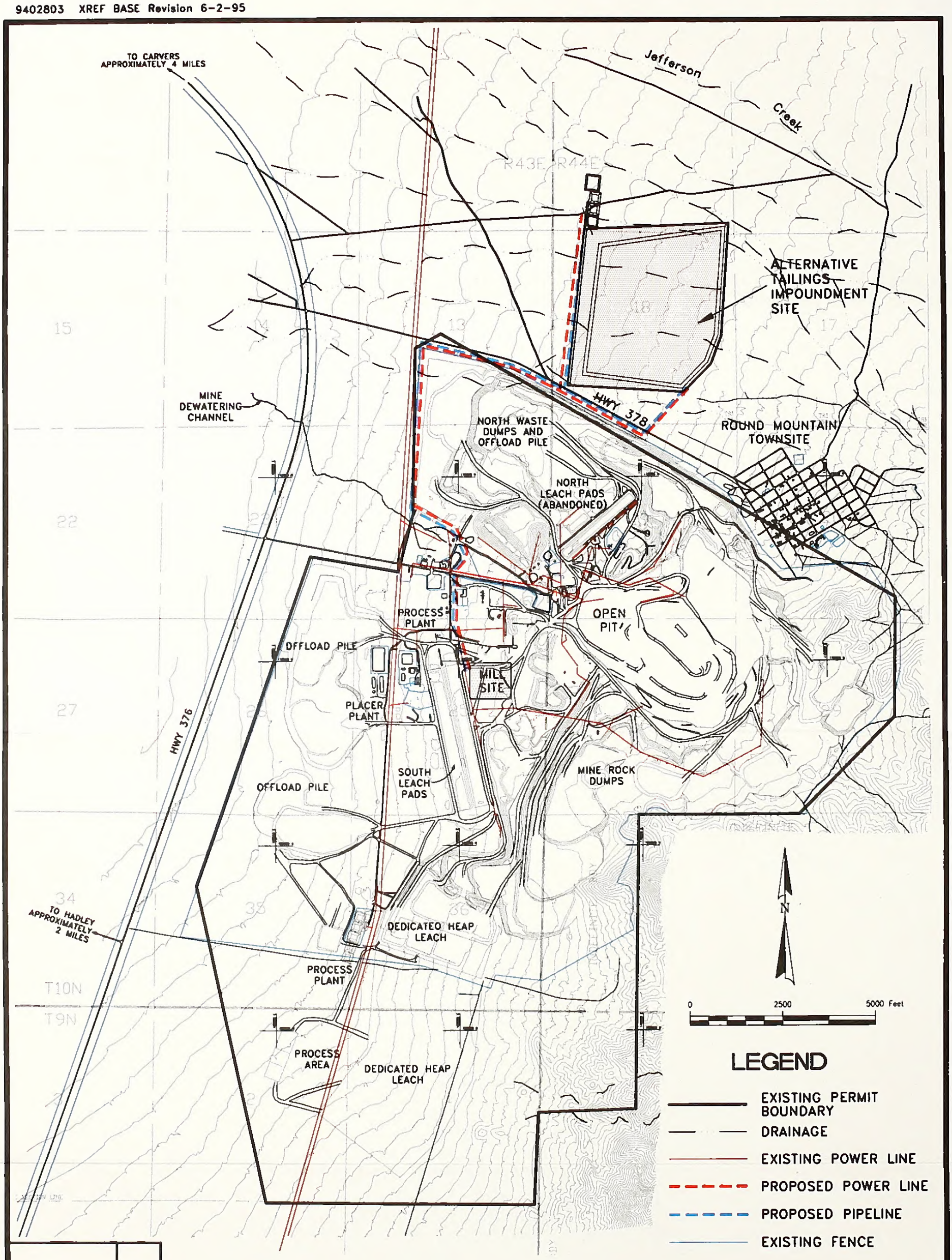
As defined in the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations 1508.7), "*Cumulative impact* is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Actions with the potential for cumulative impacts must be included within the scope of an EIS (40 Code of Federal Regulations 1508.25).

The BLM has identified past, present, and reasonably foreseeable future actions with the potential to result in cumulative impacts with the proposed project. These actions were identified based on the type of activity, geographic location, and time period to determine the potential for cumulative impacts to individual resources. A brief description of these actions is provided in this section. The cumulative impact study area and the potential cumulative impacts for each resource are described in the respective cumulative impact sections of Chapter 3.

2.5.1 Past and Present Actions

Mining in the southern Toquima Range has historically included surface placer operations, exploration (drilling, trenching, sampling, and road construction), underground mining, and recent open pit mining. The surface disturbance associated with these mines includes mine workings (adits, shafts, prospect pits), open pits, dredge deposits, waste rock piles, heap-leach pads, tailing ponds, and ore milling and other processing facilities. Within the region, mining activity has been centered around five primary mineralized districts: Round Mountain, Manhattan, Gold Hill, Jefferson Canyon, and Barcelona (Shawe 1988). The location and approximate areal extent of these mining districts is shown in ***Figure 2-9.*** ***Table 2-7*** presents the acreages of disturbance for each area. The area covered by each district was inferred from 7.5-minute U.S. Geological Survey topographic maps and aerial photographs. Although not shown on the map, other small-scale mining and exploration operations have resulted in isolated areas of land disturbance outside of the named mining districts.

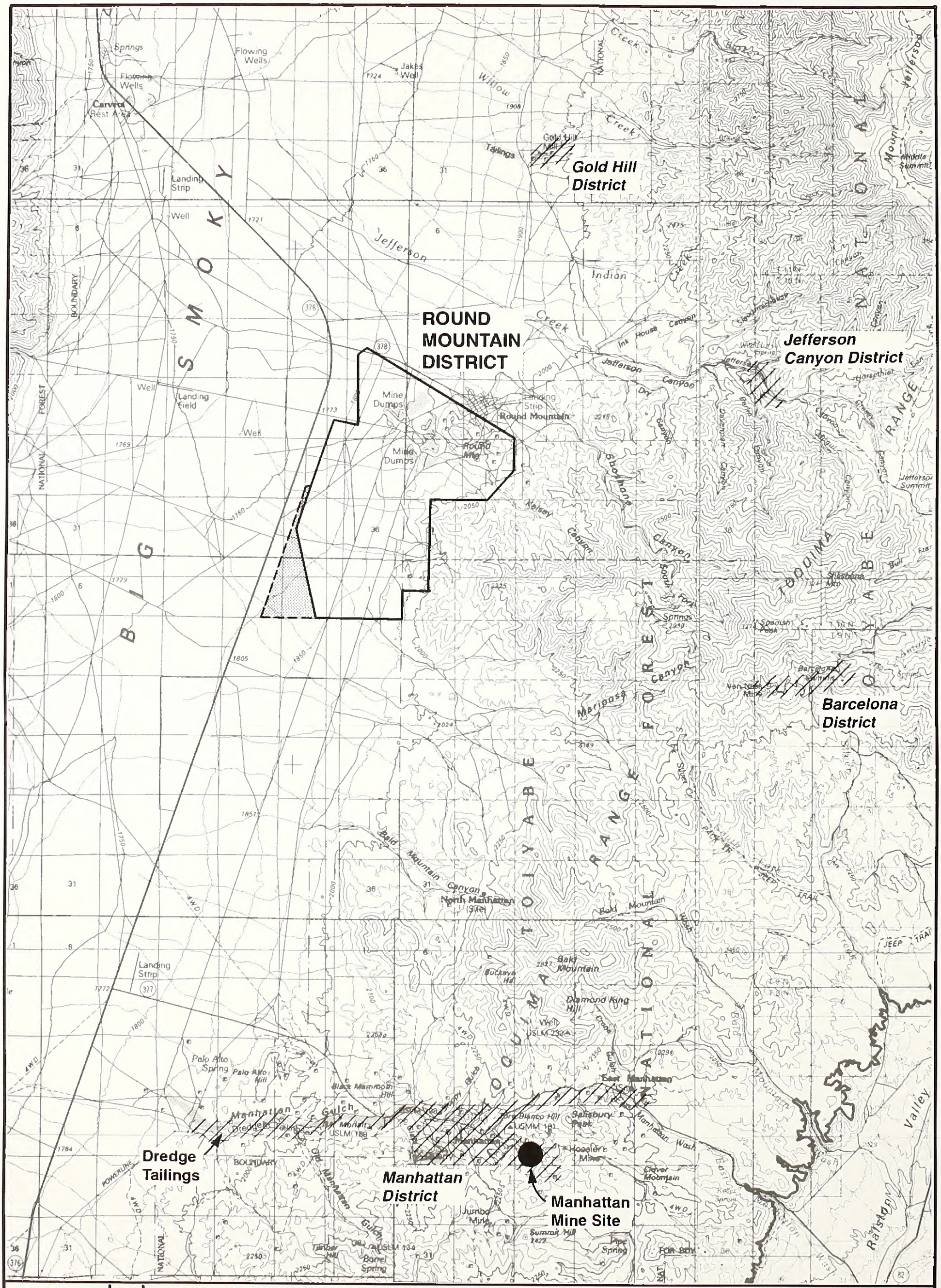
[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.



Round Mountain Mine

Figure 2-8
Tailings Alternative

Source: Modified from RMGC 1995 (Site Plan)



Source: Shawe 1988, Mills et al 1988

Base Maps: U. S. Geological Survey
1:100,000 Scale Topographic Series:
Ione Valley, Nevada 1985
Mount Jefferson, Nevada 1978

Figure 2-9
Areas of Existing Mine Disturbance

Round Mountain Mine

TABLE 2-6
Partial Pit Backfill Requirements

Mining Equipment	Quantity	Hours	$/hour	Cost
P & H Shovel	2	78,410	158	12,388,800
994 Loader	1	39,205	129	5,057,453
789 Truck	15	588,076	112	65,864,508
Road Grader	2	78,410	78	6,115,990
D9 Bull Dozer	3	117,615	76	8,938,755
334 RT Dozer	2	78,410	70	5,488,709
Water Truck	2	78,410	60	4,704,608
Sub-Total		1,058,537		$108,558,823
General Personnel		**Man-hours**	**$/hour**	**Cost**
Administrative	20	191,965	25	4,799,113
Technical	5	47,991	25	1,199,778
Safety/Security	10	95,982	25	2,399,557
Sub-total	35	335,938		$8,398,448
TOTAL				**$116,957,271**

Source: RMGC 1995b

Table 2-7
Existing Mining Disturbances

District	Disturbance (Acre)
Round Mountain District	4,767
Manhattan District	3,409
Barcelona District	548
Jefferson Canyon District	385
Gold Hill District	342
TOTAL	9,451

2.5.1.1 The Round Mountain District

Historic mining activities and gold and silver production in the Round Mountain District have been associated with placer operations, underground mining, and open-pit mining for gold. The Round Mountain Mine is the only active large-scale mining operation currently in production in the area. The total surface area permitted for land disturbance at the Round Mountain Mine is approximately 4,767 acres (***Table 2-1***).

The mine has expanded and new facilities have been added, as necessary. A summary of the existing operation and recent expansions is presented in Section 2.2.2, History of Exploration and Mining, and ***Table 2-1***.

2.5.1.2 The Manhattan District

Although the Manhattan District encompasses an area of approximately 20 square miles, most production has come from an east-west oriented belt 0.6 mile wide and 6 miles long centered on the town of Manhattan (Maddry et al. 1988). The district's early production (1905-1947) came from numerous underground mines and surface placer operations. A large drag line dredge operated in Manhattan Gulch from 1938 to 1947. Intermittent open pit gold mining/heap leaching operations were conducted at the Manhattan Mine between 1973 and 1993. Echo Bay is the current owner of the Manhattan Mine and is in the process of completing closure activities, which will involve reclaiming approximately 289 acres of surface disturbance. Operations at the

Manhattan mine, along with the dredging that occurred in Manhattan Gulch, have caused the largest amount of land disturbance within the Manhattan District. Total disturbance in the Manhattan District is approximately 3,409 acres.

2.5.1.3 The Gold Hill District

The Gold Hill District is a relatively small mineralized district that includes the Gold Hill Mine. Historically, approximately 19,000 ounces of gold and 185,000 ounces of silver were produced from the Gold Hill Mine. Recent exploration activities conducted by Echo Bay in the Gold Hill area resulted in a small amount of additional surface disturbance. The exploration programs were conducted so that disturbances would only occur on areas encompassing less than 5 acres at one time (approximately 342 acres of total disturbance). Reclamation of each disturbed parcel was completed before any new disturbance was created. No additional exploration is planned for the Gold Hill area, and all reclamation has been completed. The potential mineral reserves in this district are unknown.

2.5.1.4 The Jefferson Canyon District

The Jefferson Canyon District is a historical mining area with mine ruins and an abandoned mining town. The district historically produced 1,000 ounces of gold and 300,000 ounces of silver. Exploration in the district by Echo Bay has indicated that the district contains reserves of gold and antimony that could potentially be mined in the future (Mills, Boden, and Sander 1988). The exploration activities resulted in approximately 12 acres of disturbance that were primarily associated with the development of exploration drill roads. All land disturbances related to the exploration activities in the Jefferson Canyon area have been reclaimed by Echo Bay (approximately 385 acres).

2.5.1.5 The Barcelona District

The majority of surface disturbances in the Barcelona District (approximately 548 acres) resulted from the operation of the Van Ness and Flower Mines. These mines historically produced 1,000 flasks of mercury; other small mines in the district recorded small production of gold, silver, and lead (Mills, Boden, and Sander 1988). There are no active or proposed mining operations in the district, and potential mineral reserves are unknown.

2.5.2 Reasonably Foreseeable Future Actions

2.5.2.1 Round Mountain Mine

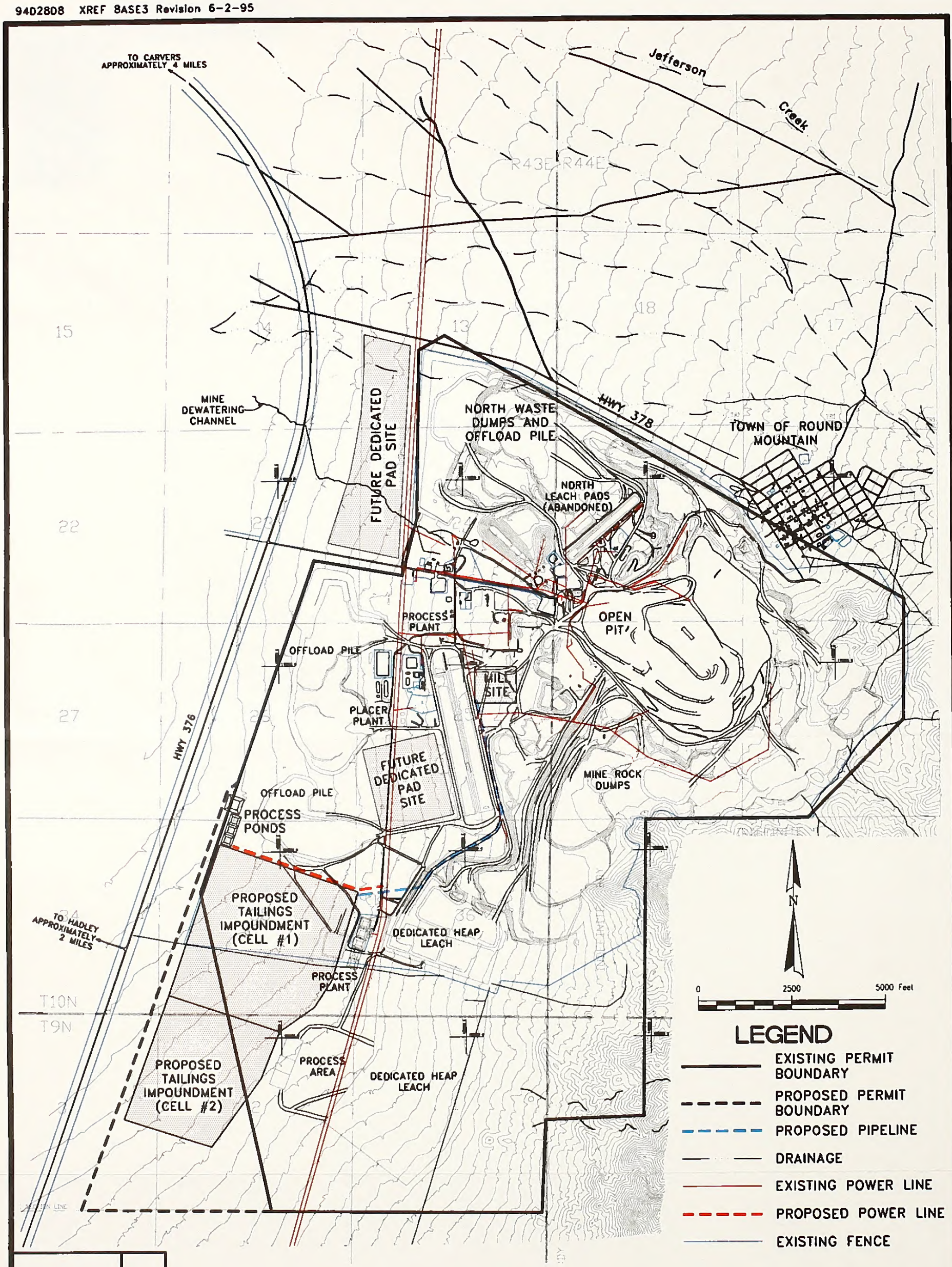
The SVCO is considering the future construction and operation of two additional dedicated leach pads at the Round Mountain Mine. The approximate locations of these potential future facilities are shown in ***Figure 2-10***. The need for these facilities will continue to be evaluated as exploration and development of the Round Mountain Mine continues.

The SVCO currently anticipates that these dedicated leach pads could be constructed during the next 5 years. These pads may be constructed to reduce the use of the reusable leach pads located to the west of the proposed mill site. Mining of the ore from the open pit to be processed on these dedicated pads has previously been approved; therefore, an increase in the size of the pit would not be part of this action.

The future dedicated leach pads would cover approximately 290 acres. Both of the future pads would be located within the permitted project boundary, one to the west of the reusable leach pads and the other to the west of the north waste dumps. The pads would range in height from approximately 250 feet to 300 feet. The pads would accommodate approximately 210 million tons of ore. Run-of-mine ore would be transported to the dedicated pads via haul trucks; it is anticipated that approximately one additional haul truck would be required. The existing adsorption/desorption and refinery plant located west of the reusable pads and the proposed mill would process the leached ore.

2.5.2.2 Cyprus Tonopah Copper Mine

The Cyprus Copper Company is proposing to construct and operate a copper mine near the existing Cyprus molybdenum mine in Tonopah, Nevada (Graham 1994). The project would be located on approximately 400 to 500 acres of private and state lands. The project would mine and heap leach approximately 100 million tons of material. The construction schedule is unknown, although it would be completed in approximately 1 year. Project operations would continue for approximately 10 to 15 years. The construction workforce would number 50 to 75 people with a permanent workforce of approximately 120 people.



Round Mountain Mine

Figure 2-10
Reasonably Foreseeable Future Actions

Source: Modified from RMGC 1995 (Site Plan)

2.5.2.3 Other Activities

The BLM is not aware of any major changes in the type or level of activity proposed at the Nevada Test Site southeast of Tonopah. The total workforce has been declining and this decline is expected to continue. The emphasis at the site appears to beshifting toward facility maintenance, environmental cleanup, and special projects (Planning Information Corporation 1993b). However, geologic/environmental site studies are ongoing at the Yucca Mountain site for possible high-level nuclear waste disposal.

2.6 Agency Preferred Alternative

In accordance with NEPA, the lead agency is required by the Council on Environmental Quality (40 Code of Federal Regulations 1502.14) to identify its preferred project alternative in the EIS. The BLM's preferred alternative is the range management alternative. The rationale for selecting this alternative follows.

- It would encourage better grazing distribution in the project area allotments and improved vegetation in the corridor between State Highway 376 and the Round Mountain Mine.
- It is technically and economically feasible.

2.7 Comparative Analysis of Alternatives

Table 2-8 summarizes and compares the environmental impacts between the proposed action and the project alternatives. The impacts associated with individual component alternatives are identified only as they differ from the same impact for the proposed action. Detailed descriptions of the impacts are presented in Chapter 3, Affected Environment and Environmental Consequences. The summarized impacts assume the absence of mitigation; implementing the monitoring and mitigation measures recommended in Chapter 3 would potentially reduce the impacts.

TABLE 2-8
Impact Summary and Alternatives Comparison

Issue	Proposed Action	Range Management Alternative (Agency Preferred Alternative)	Tailings Impoundment Alternative	No Action Alternative
Geology and Minerals				
Seismicity Impacts	Minimal impacts with appropriate design and construction	Same as proposed action	Same as proposed action	No change
Future availability of mineral resources	No expected impacts	Same as proposed action	Same as proposed action	No change
Water Quantity and Quality				
Drawdown effects on wells	Water levels in Round Mountain townsite wells could potentially be impacted	Same as proposed action	Same as proposed action	Same as proposed action
Drawdown effects on perennial streams and springs	No expected impacts	Same as proposed action	Same as proposed action	Same as proposed action
Degradation of surface water quality	Contamination of runoff from leach offload piles	Same as proposed action	Same as proposed action	Same as proposed action
Degradation of ground water quality	No expected impacts	Same as proposed action	Same as proposed action	Same as proposed action
Flooding, erosion, and sedimentation	No expected impacts	Same as proposed action	Higher potential for channel instability, erosion, and flooding impacts to tailings impoundment	No change
Pit lake water quality impacts	Increased levels of certain metals and elements, but no expected impacts to waters of the state	Same as proposed action	Same as proposed action	Same as proposed action
Soils and Watershed				
Acreage of soil disturbance (outside of existing permit area)	250 acres	Impacts less than proposed action	439 acres	No change
Growth medium availability	Average 11.8" salvage depth	Same as proposed action	Average 16.7" salvage depth	No change
Upper soil erosion susceptibility	Water erosion - slight; wind erosion - high	Same as proposed action	Water erosion - high; wind erosion - high to very high	No change
Vegetation				
Acreage of disturbance (acreages outside existing permit area)				
Shadscale	13 acres	Same as proposed action	35 acres	No change
Fourwing Saltbush	0	0	0	No change
Greasewood	237 acres	Same as proposed action	404 acres	No change
Total	250 acres	Same as proposed action	439 acres	No change
Vegetation condition in corridor along State Highway 376	Continued deterioration, permanent damage	Improved conditions	Continued deterioration, permanent damage	Continued deterioration, permanent damage
Impacts to threatened or endangered species	None	None	None	None
Wildlife and Fisheries Resources				
Impacts to terrestrial wildlife and waterfowl	Potential long-term toxic impacts to individual waterfowl and to waterfowl populations due to pit water quality	Same as proposed action	Same as proposed action	Same as proposed action
Impacts to threatened or endangered species	No expected impacts	No expected impacts	No expected impacts	No change
Range Resources				
Area of direct forage loss (outside existing permit area)	250 acres	250 acres	439 acres	No change
Area of restricted forage use	No expected impacts	893 acres	No expected impacts	No change
Range condition in corridor along State Highway 376	Continued deterioration, permanent damage	Improved conditions	Continued deterioration, permanent damage	Continued deterioration, permanent damage
Livestock distribution	Major increases in cattle over-grazing near new water sources	Improved grazing distribution in project area	Minor increases in cattle congregation	No change
Ranching economics	Little or no change	Increased cost of hauling water	Little or no change	No change

TABLE 2-8
Impact Summary and Alternative Comparison
(continued)

Issue	Proposed Action	Range Management Alternative (Agency Preferred Alternative)	Tailings Impoundment Alternative	No Action Alternative
Paleontological Resources				
Disturbance/loss of known resources	No expected impacts	No expected impacts	No expected impacts	No change
Cultural Resources				
Historical/archaeological values	No impacts to National Register of Historic Places - eligible sites	Same as proposed action	Same as proposed action	No change
Native American traditional values	No expected impacts	Same as proposed action	Same as proposed action	No change
Air Quality				
Fugitive dust and equipment emissions	Slight local increase during construction	Same as proposed action	Similar to proposed action	No change
Exceedance of PM_{10} concentrations	Slight increases not exceeding standards	Same as proposed action	Similar to proposed action	No change
Access and Land Use				
Impacts to traffic	Slight increase during construction	Similar to proposed action	Similar to proposed action	No change
Impacts to land use plans and patterns	Conversion of 250 acres from grazing to mining outside existing permit area	Short-term removal of 250 acres from grazing use; restoration of grazing on 893 acres	Conversion of 439 acres from grazing to mining outside existing permit area	No change
Recreation and Wilderness				
Recreation availability and demand	No significant changes expected	Same as proposed action	Same as proposed action	No change
Impacts to recreation quality	No expected impacts	Same as proposed action	Same as proposed action	No change
Social and Economic Values				
Employment	Average construction workforce of 104 workers and addition of 43 permanent employees	Same as proposed action	Same as proposed action	Loss of additional employment benefits
Demographics	Peak population increase of 200 people in 1996 during construction phase	Same as proposed action	Same as proposed action	No change
Local economic benefits	7.5% increase in mining employment; $13.9 million payroll during construction, $2.3 million annual payroll during operations; increased capital expenditures and sales and use tax revenues	Same as proposed action	Same as proposed action	Loss of beneficial economic impacts of proposed action, i.e., increased employment and revenues
Housing	Demand not likely to exceed supply	Same as proposed action	Same as proposed action	No change
Services and facilities	Potential small, short-term impacts to public utilities and services during construction	Same as proposed action	Same as proposed action	No change
Transportation	No expected impacts	Same as proposed action	Same as proposed action	No change
Visual Resources				
Compatibility with VRM objectives	Increase in visual impacts along State Highway 376	Same as proposed action	Similar to proposed action, but impacts would be greater to viewers approaching from north	No change
Noise				
Projected noise levels at sensitive receptors	Short-term, slight increase in noise levels for Hadley residents during construction activities, but within acceptable limits	Same as proposed action	Similar to proposed action, but impacts would be more noticeable at Round Mountain townsite than in Hadley	No change
Hazardous Materials				
Transportation risks	Slight increase	Same as proposed action	Same as proposed action	No change
Storage, use, and disposal risks	Slight increase	Same as proposed action	Same as proposed action	No change

3.0 Affected Environment and Environmental Consequences

CHAPTER 3.0 Affected Environment and Environmental Consequences

This chapter describes the environment that would be affected by the development of the proposed action or the project alternatives. The environmental baseline information summarized in this chapter was obtained from field and laboratory studies of the project area, published sources, unpublished materials, and communication with relevant government agencies and private individuals with knowledge of the site. The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the proposed expansion, i.e., the area beyond the existing approved permit boundary. For some resources, such as geology, soils, and vegetation, the affected area was determined to be the physical location and immediate vicinity of the areas to be disturbed by the project. For other resources, such as water quantity and quality, air quality, and social and economic values, the affected environment comprised a larger area, i.e., watershed, airshed, local counties, etc.

This chapter describes the anticipated direct, indirect, and cumulative impacts of the proposed action and the project alternatives, including the no action alternative. Monitoring and mitigation measures developed in response to the impacts are recommended by the BLM for individual resources. These measures are not part of the SVCO's *Plan of Operations Amendment* for the proposed project but could be required by the BLM or other regulatory agencies as conditions or stipulations of approval and authorization of the *Plan of Operations Amendment*. This chapter also identifies residual adverse effects, i.e., the effects that would remain following the implementation of mitigation measures.

In addition to the proposed mill and tailings facility, the impact assessment also addresses potential impacts associated with pit dewatering and water quality and the leach offload piles.

The proposed expansion may result in impacts interrelated with other past, present, and reasonably foreseeable activities in the area. For resources where project-specific impacts are identified, the cumulative impacts associated with the proposed expansion together with other interrelated projects were evaluated. The period of potential cumulative impacts is defined as the life of the project, 1996 through 2008.

This chapter is organized by environmental resource. Sections 3.1 through 3.15 describe the existing conditions and potential environmental impacts associated with each resource. The short-term use of the environment relative to the long-term productivity of resources is discussed in Section 3.16. The irreversible or irretrievable commitment of resources is presented in Section 3.17.

3.1 Geology and Minerals

3.1.1 Affected Environment

This section addresses the topography, regional geology, bedrock geology, surficial deposits, seismicity, geologic hazards, and mineral resources for the Round Mountain Mine. A general summary of the geology and mineral resources is presented in Chapter 2, Description of the Proposed Action and the Alternatives. This section provides a more detailed description of the regional and site-specific geologic conditions. The geologic conditions discussed below also provide background information for the characterization of the hydrogeologic conditions presented in Section 3.2, Water Resources.

3.1.1.1 Physiographic and Topographic Setting

The project site is situated along the eastern side of the Big Smoky Valley within the Great Basin section of the Basin and Range Physiographic Province. This Basin and Range Province is characterized by a series of generally north-trending mountain ranges separated by broad basins. This physiography has developed from extensive normal faulting initiated 10 to 12 million years ago (Ekron et al. 1968) and continues to develop today. The mountains consist of uplifted blocks of Precambrian to Tertiary bedrock units. The basins are filled with thick accumulations of unconsolidated sediments that were generally derived from erosion of the adjacent bounding mountain ranges.

The Big Smoky Valley is bounded by the Toiyabe Range on the west and the Toquima Range on the east. Elevations range from over 11,000 feet in the highest peaks along the ridge crest to 5,540 feet in the valley floor. The project spans from the lower western flank of the Toquima Range to the eastern margin of the Big Smoky Valley. The elevation across the project site ranges from approximately 6,600[1] to 5,800[1] feet.

3.1.1.2 Regional Geologic Setting

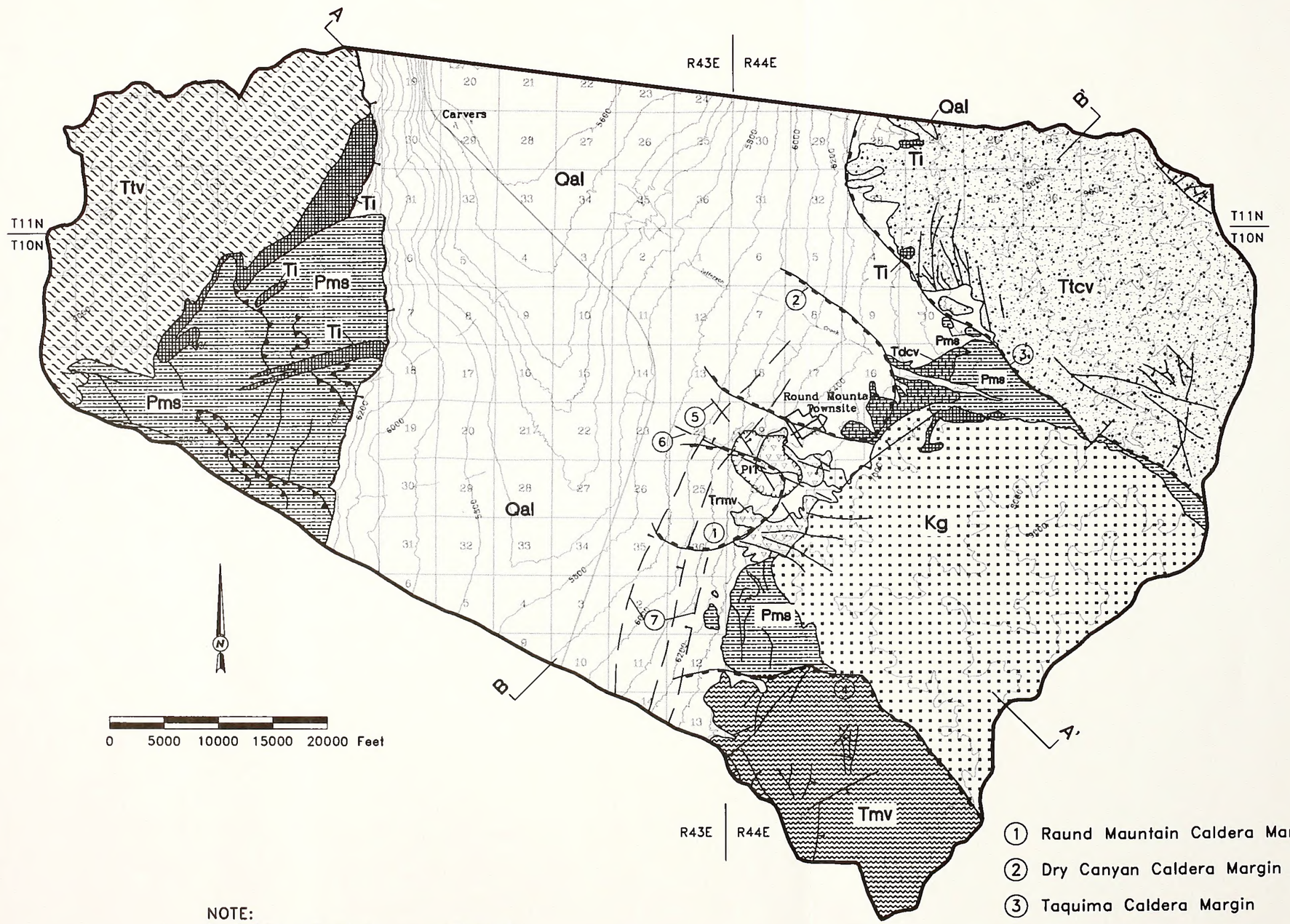
The generalized regional geologic conditions in the vicinity of the project site are presented on the regional geologic map, ***Figure 3-1***, and the schematic geologic cross sections, ***Figure 3-2.*** The map and cross sections are based on drawings prepared by SVCO geologists (Hydro-Search, Inc. 1994a). The major geologic units, from oldest to youngest, include Paleozoic metasedimentary rocks, Cretaceous granitic rocks, Tertiary volcanic tuffs and related intrusive rocks, and Quaternary alluvium.

The Paleozoic metasedimentary rocks and Cretaceous granitic rocks form the basement assemblage throughout the region. The Paleozoic rocks were deposited as sediments in a shallow sea approximately 400 to 500 million years ago. These metasedimentary rocks crop out near the mouth of Jefferson and Mariposa Canyons in the Toquima Range and over large portions of the Toiyabe Range. These rocks are also inferred to underlie the volcanics and alluvial deposits in the Big Smoky Valley. The Paleozoic sequence was subjected to extensive compressional tectonics during the Antler Orogeny (Shawe 1984) approximately 350 million years ago. As a result of these tectonics, the Paleozoic rocks in this area consist of highly folded thrust sheets composed of several lithologic groups, including quartzite, argillite and schist, and limestone (Maddry et al. 1988, Shawe 1988).

The Paleozoic sedimentary sequence was intruded by a series of Cretaceous intrusive stocks approximately 60 to 100 million years ago. These stocks are granitic in composition and are distinguished by textural variation. One of these stocks crops out in the Toquima Range immediately east of the mine and partially underlies portions of the mine. Although not shown on the regional geologic map, a series of Tertiary rhyolite dikes emplaced approximately 35 million years ago is exposed east of the project site in a north-trending zone approximately 1 mile wide and 7 miles long. The dikes range in size from 5 to 25 feet wide, are up to 2 miles long, and are intruded into the Cretaceous granite and Paleozoic rocks.

In the Tertiary period 20 to 40 million years ago, the region surrounding the project site was subjected to extensive volcanism and caldera development (large, fault-bounded volcanic center). Detailed geologic mapping in the area has determined the presence of four major caldera complexes, each associated with an eruption of one or more ash-flow tuff sheets and associated volcaniclastic and intrusive rocks. As shown in ***Figure 3-1***, these caldera complexes include, from oldest to youngest, the Dry Canyon caldera

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.



LEGEND

- Qal — Quaternary Alluvium
- Ti — Tertiary Intrusive
- Tmv — Tertiary Manhattan Valcanics
- Ttcv — Tertiary Taquima Caldera Complex Valcanics
- Trmv — Tertiary Raund Mauntain Valcanics
- Ttv — Tertiary Taiyabe Valcanics
- Tdcv — Tertiary Dry Canyan Valcanics
- Kg — Cretaceaus Granite
- Pms — Paleazaic Metasedimentary Rocks
- Unit Cantact
- Caldera Margin
- Fault Painting ta Downstream Block (Dashed where cancealed by alluvium or inferred)
- Thrust fault–Sawteeth in Upper Plate
- Pit Limit
- A — A' Crass Sectian Lacatian

SOURCE MAP:
RMGC Gealagic Map
Sauthern Smokey Valley
Water Resaurce Area (unpublished)
June 30, 1994
Scale 1" = 4000'

Modified from: Hydro–Search, Inc. 1994a

NOTE:
1. Caldera Margins were defined by drilling in the Alluvial (Qal) areas.
2. Geologic units located within the apen pit reflect premining canditians.

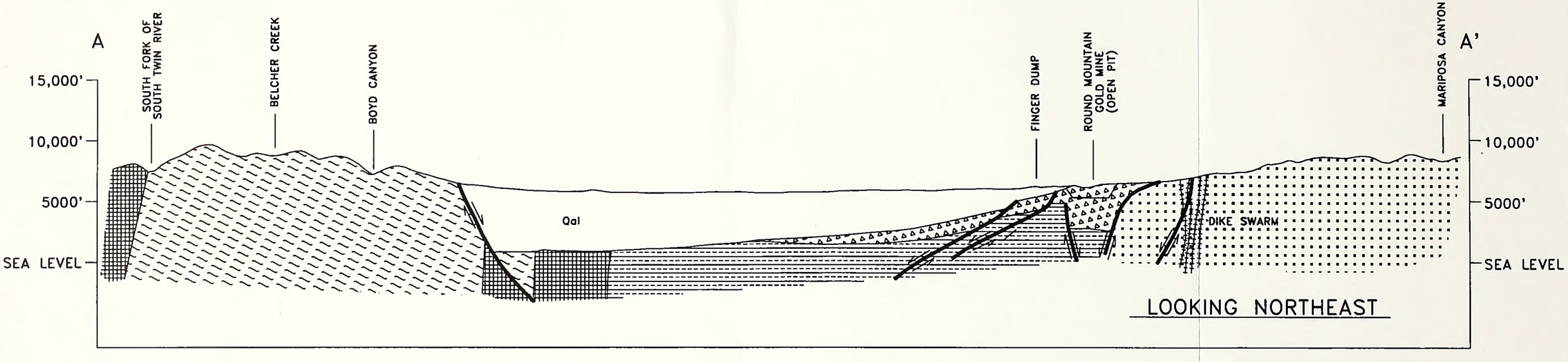
1. Raund Mauntain Caldera Margin
2. Dry Canyan Caldera Margin
3. Taquima Caldera Margin
4. Manhattan Caldera Margin
5. Autamatic Fault Zane
6. Fluarite Fault Zane
7. Basin & Range Faults

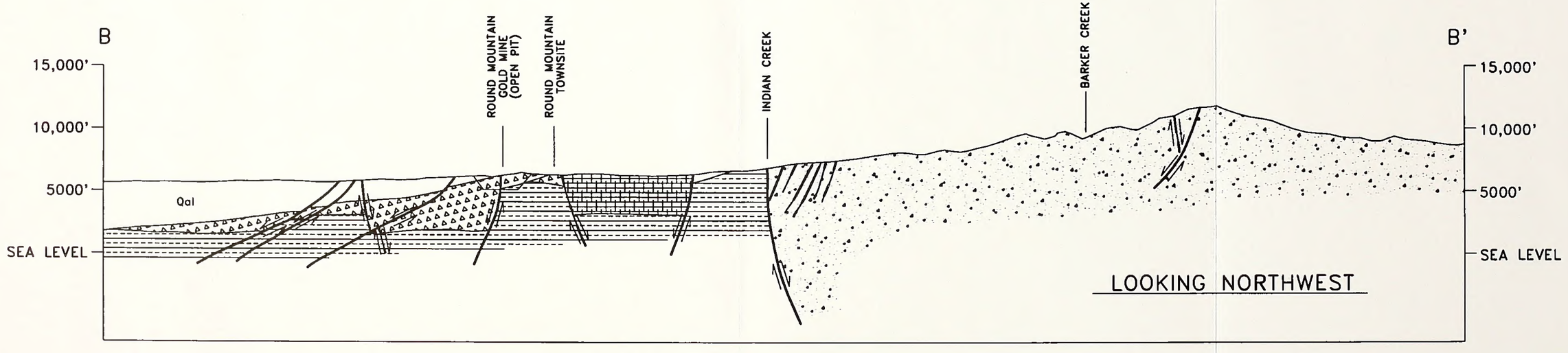
Round Mountain Mine

Figure 3-1

Regional Geologic Map

GEOBASE3 Revision 4-25-95





LEGEND

- Quaternary Alluvium
- Tertiary Intrusive
- Tertiary Toquima Caldera Volcanics
- Tertiary Round Mountain Volcanics
- Tertiary Toiyabe Volcanics
- Tertiary Dry Canyon Volcanics
- Cretaceous Granite
- Paleozoic Metasediments
- Fault w/Movement Direction
- Unit Contact
- Tertiary Rhyolite Dikes

0 4000 8000 Feet

HORIZONTAL = VERTICAL

Geologic Cross Section Basemap Source: Cross Sections, Southern Smoky Valley Water Resources, RMGC June 30, 1994

Source: Modified from Hydro-Search, Inc. 1994a

Round Mountain Mine

Figure 3-2

Schematic Geologic Cross Sections A-A' and B-B'

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located immediately north of the project site in the vicinity of the Round Mountain townsite, the Round Mountain caldera located beneath the project site, the Toquima caldera complex centered around Mount Jefferson several miles north of the project site, and the Manhattan caldera complex located approximately 4 miles south of the project site. The reported age and associated volcanic eruptive sequence for the four identified calderas are presented in ***Table 3-1.***

SVCO geologists believe that the ash flow tuffs that host the majority of mineralization in the deposit were erupted from the Round Mountain caldera located under and to the south and southwest of the present day pit (Veek 1994). The recognition of the caldera structures is important since the mineralization at the Round Mountain Deposit, Jefferson Canyon Deposit, and Gold Hill Mine are associated in time and space with caldera development (Mills et al. 1988). In addition, most of the major mineralized areas are located near mapped caldera margins.

Beginning in the late Cenozoic, 10 to 12 million years ago, the area was block-faulted by a series of normal faults. The Big Smoky Valley is one of many valleys throughout Nevada formed as a downdropped block between uplifted mountain ranges. Major normal faults or fault zones are located near both the east and west margins of the Big Smoky Valley at the intersection of the mountain fronts. Vertical movement of several thousand feet are not uncommon along these structures.

Uplift and subsequent erosion of the mountains partially filled the basin with unconsolidated silt, sand, gravel, and boulders deposited by fluvial and lacustrine processes during late Tertiary and Quaternary time. The thicknesses of these deposits range from a thin veneer on pediment slopes to over several thousand feet in the valley center. Based on gravity surveys (Healey et al. 1981), the thickness of these deposits is estimated to be on the order of 3,000 to 5,000 feet along the central and western margins of the valley. The flanks of the Big Smoky Valley are characterized by a series of coalescing alluvial fans that slope toward the axis of the valley. Most of the project site is situated on these alluvial fans.

General Site Geology.

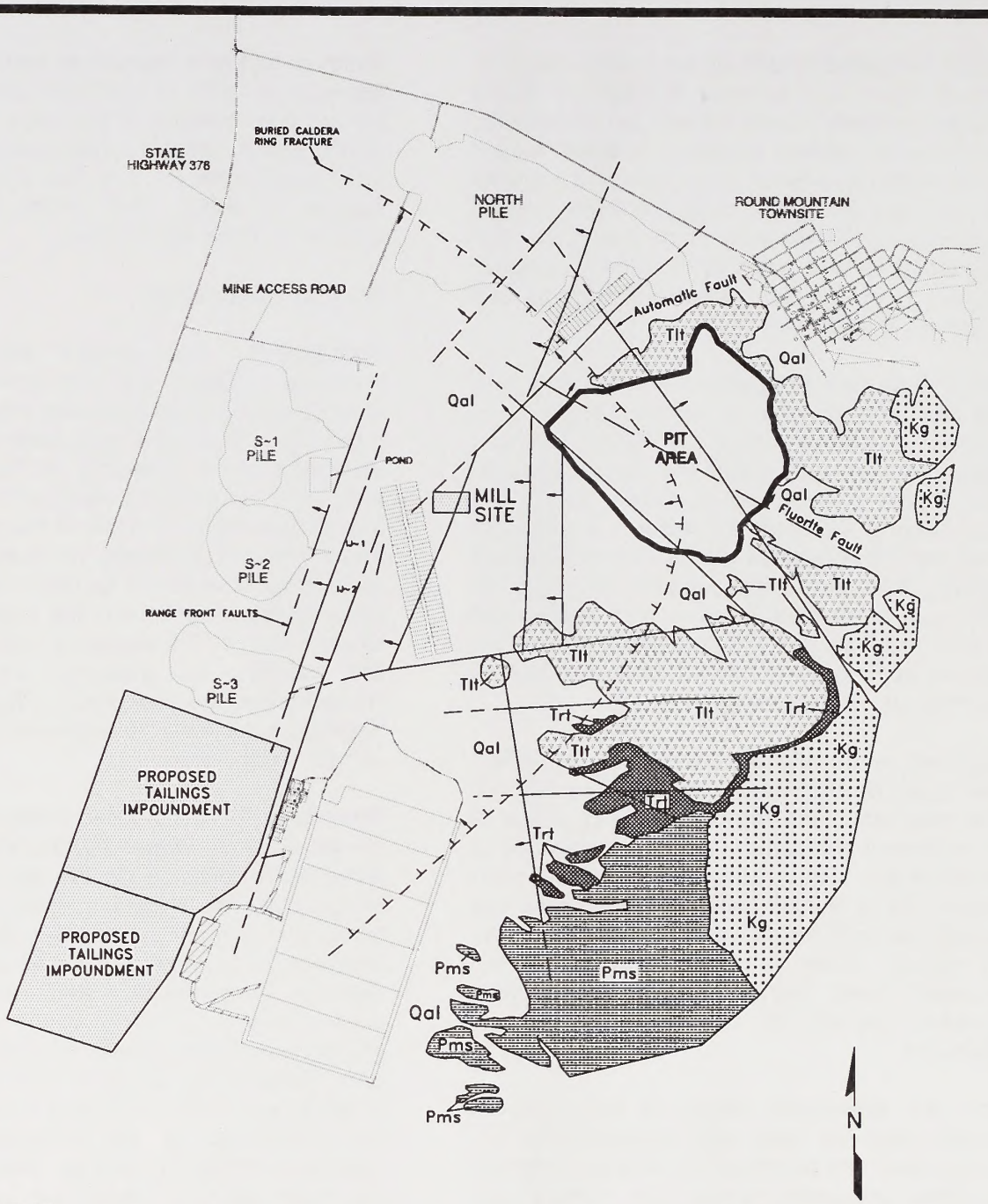
Stratigraphy. The general site geology is illustrated in ***Figure 3-3***. The stratigraphy in the immediate project area includes most of the major rocks types previously described for the region. Basement rocks consisting of Paleozoic metasediments and granitic plutons are exposed on the east and southeast portions of the mine area. The Tertiary Round Mountain Volcanics, the primary ore host rocks at Round Mountain, are exposed in the northeastern portion of the project site, which includes the pit. The western portion of the project site, including the proposed mill and tailings impoundment, existing leach offload piles, and heap-leach facilities, is underlain by Quaternary alluvial fan deposits.

Structure. The major fault zones on the project site are shown in ***Figure 3-3***. Basin and range type faults are manifested on the site as a zone of subparallel, north to northeast-trending, range-front faults, each exhibiting hundreds of feet of down-to-the-west displacement. In an east-to-west direction, the range-front fault zone extends from the western segment of the pit to the eastern side of the proposed tailings facility and the leach offload piles. Several other faults, or fault zones, mapped in the vicinity of the pit appear to have controlled the occurrence of the mineralization. These structures include the Stringer Zone master fault, the Automatic fault zone, and other unnamed northeast and northwest striking structures. The stratigraphy, ore deposit, and major structures in the vicinity of the pit are described in the following section.

TABLE 3-1
Relation and Age of Recognized Caldera Complexes and Volcanic Tuff Units

Caldera Source	Age (millions of years bp)	Unit
Manhattan Caldera Complex	25.0	Manhattan Volcanics
Toquima Caldera Complex	26.4	Toquima Caldera Complex Volcanics
Round Mountain Caldera	26.7	Round Mountain Volcanics
Dry Mountain Caldera	32.3	Dry Mountain Volcanics

bp-before present
Source: Veek 1994, Shawe 1988, Sander 1988



LEGEND

Qal — Quaternary Alluvium/Colluvium, Includes Holocene to Pleistocene (?) Grovel, Sond, and Silt in Alluviol Fans, Terroces, and Modern Streom Bottoms.

Tlt / Trt — Tertiory Round Mountain Volcanics

- Tlt — Miocene or Oligocene Latitic, Quartz-Latitic, and Rhyolitic Ash-Fall and Ash-Flow Tuff (about 25 m.y. old).
- Trt — Miocene or Oligocene Rhyolitic Ash-Flow Tuff, In Part Strongly Welded (about 26 m.y. old).

Kg — Cretoceous Gronite of Shoshone Peak (about 95 m.y. old).

Pms — Paleozoic Undifferentioted, Includes Ordovician Toquimo Formation, Ordovician (?) Zonzibor Limestone, and Unnomed Ordovician (?) or Cambrian (?) Quartzite, Schist and Limestone.

Fault, Doshed Where Inferred, Arrow on Down-Dropped Side.

Note: Fault Location by RMGC

Source: Modified from Hydro-Search, Inc. 1994a

Round Mountain Mine

Figure 3-3

Site Geology Map

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Mineralization and Pit Geology. Mineralization occurs within a 4-square-mile hydrothermally-altered zone centered in the vicinity of the open pit. Mineralization was formed by hydrothermal solutions transporting gold, silver, and other metals from the basement rocks up into the overlying volcanic sequence. Movement of the fluids and ore deposition are thought to have been controlled by the dominant northwest-trending fractures formed at the caldera's margin. Most of Round Mountain's gold occurs as electrum, an alloy of gold and silver, in an approximately 2:1 ratio (Spickelmier 1993).

The stratigraphy in the vicinity of the ultimate pit is presented in the map and cross section in ***Figure 3-4***. The oldest rocks exposed in the pit are Paleozoic metasedimentary basement rocks, consisting of quartzite, phyllite, carbonaceous argillite, schist, and impure limestone metamorphosed by later Cretaceous igneous activity. Cretaceous granitic rocks are also exposed locally in the bottom of the pit. Mineralization in both of these rocks is localized primarily along faults and fracture zones. Basement rocks are overlain by the Tertiary Round Mountain tuff sequence, which is the primary host rock for mineralization. The Round Mountain tuff consists of four distinct zones listed from bottom to top as basal "lithic tuff," poorly welded "porous tuff," moderately welded "transitional tuff," and the uppermost welded "dense tuff." The basal lithic tuff is partially oxidized with mineralization occurring primarily as quartz-carbonate veins and minor disseminations.

Mineralization in the porous and transitional tuff units consists primarily of oxidized ore in veins and disseminations. Mineralization in the densely welded tuff occurs in steeply dipping, mostly northwest-trending quartz-pyrite gold veins and stockwork that have been oxidized. Partial erosion of this unit is believed to have produced the placer gold deposit that was exploited by miners at the turn of the century.

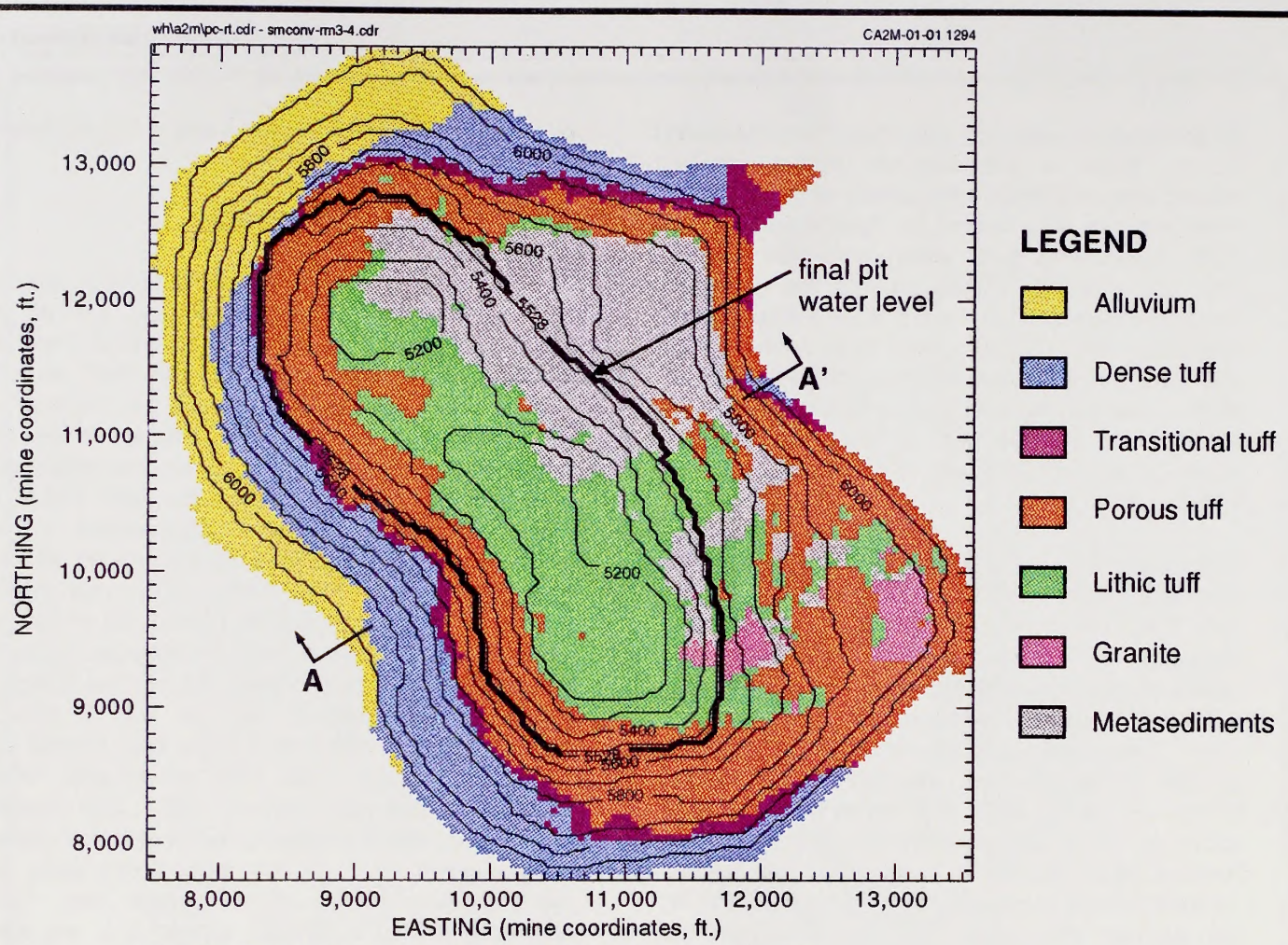
Numerous faults and fault zones have been mapped in the pit. Two important fault zones that control ore deposition include the Stringer/Fluorite fault zone and the Automatic fault zone. The Stringer/Fluorite fault zone is a west-northwest oriented structure that dips toward the northeast. The Automatic fault zone has a northwest orientation with a steep dip toward the north, and it extends from the center of the eastern wall of the pit to the northwest along the base of the northern highwall.

3.1.1.3 Faulting and Seismicity

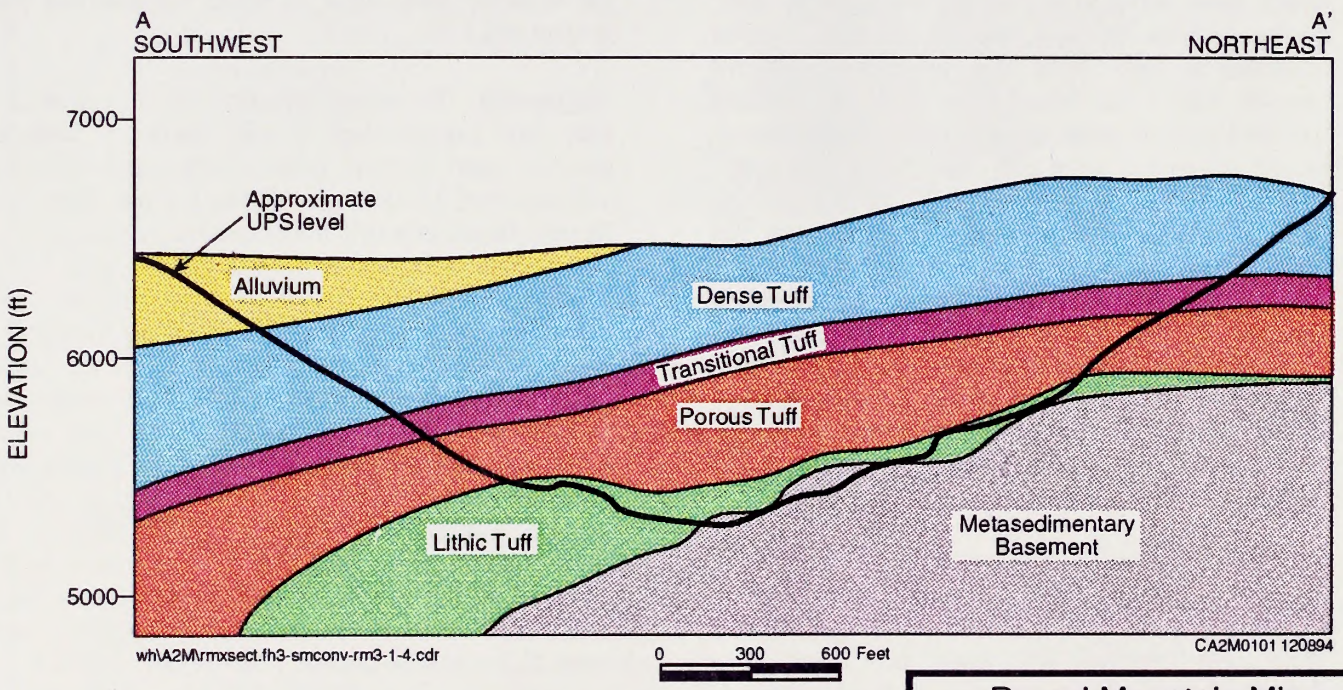
Faulting. The project site is located in a region that is characterized by active and potentially active faults and a relatively high level of historic seismicity. An active fault is one that shows evidence of displacement during the Holocene (last 10,000 years), and a potentially active fault is a fault that shows evidence of surface displacement during the late Quaternary (last 150,000 years). Historically, surface displacement along faults occurred in Nevada during major earthquakes in 1869, 1903, 1915, 1932, and three events in 1954 (SHB AGRA 1994b). All of these events occurred along a north-trending belt located west of the Big Smoky Valley; the closest historic surface displacement to the site was in 1932, approximately 41 miles west of the site. Review of published geologic maps (Whitebread and John 1992, Ferguson and Cathcart 1954), and recent stereopaired aerial photographs indicate that there are no known active or potentially active faults in the immediate vicinity of the project site. The nearest identified potentially active faults are the East Toiyabe fault approximately 5 miles west and the Monitor Valley fault 16 miles northeast of the project site.

Seismicity. The project site is located in a region that has experienced a high level of seismic activity over historic time. Earthquake records indicate that 1,178 earthquakes greater than 4.4 Richter Magnitude (M) were recorded within a 124-mile radius of the site between 1872 and 1993 (SHB AGRA 1994b). The highest concentration of earthquakes, and most of the larger earthquakes, have occurred in the Nevada Seismic Belt (Algermissen et al. reprinted 1991) located approximately 25 miles west of the site. The most significant seismic events to affect this region are listed in ***Table 3-2.*** The largest historic earthquakes to affect this region were the 1932 7.2 M Cedar Mountain earthquake 41 miles southwest, and the 1954 7.2 M Fairview Peak and 7.1 M Dixie Valley earthquakes located approximately 90 miles west of the site. No historic earthquakes of 6 M or greater have occurred within 30 miles of the site.

Design Earthquakes. Pertinent active and potentially active faults in the area were evaluated to determine the maximum credible earthquake



Rock Types Exposed in the SVCO Ultimate Pit.



Southwest-Northeast Cross Section A-A' through SVCO Pit Area

Source: PTI 1995

Round Mountain Mine

Figure 3-4

Geology and Generalized Cross Section of the Ultimate Pit

TABLE 3-2
Selected Seismic Events Affecting the Area Between 1872 and 1993

Year	Location (latitude, longitude)	Approximate Distance from the Site (miles)	Magnitude	Estimated Peak Site Acceleration
1910	38,117	46	6.3	0.02
1932	38.7, 117.8	41	7.2[1]	0.05
1954	39.5, 118	87	7.1	0.01
1954	39.3, 118.2	93	7.2[1]	0.01
1961	39, 117	23	4.2	0.02
1962	38.8, 117.2	11	4.6	0.05
1979	38.5, 117.2	17	4.8	0.04

[1]Accompanied by surface fault rupture
Source: SHB AGRA 1994b

and maximum acceleration at the site. The maximum credible earthquake is defined as the largest event considered possible under the current tectonic setting that would produce the highest horizontal acceleration. As shown in ***Table 3-3***, the maximum credible earthquake for the project site would be a 7.4 M earthquake on the East Toiyabe fault, with a corresponding maximum acceleration of 0.55 times the force of gravity at the site. Critical facilities, such as tailings impoundments, should be designed to prevent excessive deformation or collapse under this estimated maximum seismic loading.

Another important consideration for operating critical facilities is the largest probable earthquake that may affect the site during operation and closure. This operational basis earthquake often has an average recurrence of 100 years, or the probability of exceeding 0.1 in any year. SHB AGRA (1994b) evaluated the seismic history for the area and determined that, on the average, one earthquake of 5.5 M occurs per 100 years per 1,000 square kilometers. Using this data, SHB AGRA determined that the operational basis earthquake for the project site is a 5.5 M earthquake 11 miles from the site. The event would result in an estimated peak horizontal acceleration of 0.09 times the force of gravity at the site. A properly designed facility should remain functional, sustaining no more than repairable damage, if subjected to the operational basis earthquake.

3.1.2 Environmental Consequences

Issues related to geology and minerals include (1) creation or exacerbation of geologic hazards from the project development, and (2) impacts to potential future mineral resource availability. Environmental impacts to geology and minerals were judged to be significant if the proposed action or the selected alternative could result in the following:

1) Construction in an area where the facility could potentially be affected by, or induce, geologic hazards

2) Concealment or prohibition of other known mineral resources

TABLE 3-3
Estimated Maximum Credible Earthquake and Associated Horizontal Accelerations

Fault	Distance From Mine (miles)	Maximum Credible Earthquake (M)	Estimated Horizontal Ground Acceleration
East Toiyabe Fault	5	7.4	0.55 times the force of gravity
Monitor Fault	20	7.0	0.30 times the force of gravity
Background Earthquake	11	6.3	0.12 times the force of gravity

Source: SHB AGRA 1994b

3.1.2.1 Proposed Action

Direct impacts of the proposed action on geologic and mineral resources would include (1) the generation and permanent disposal of approximately 57 million tons of mill tailings, (2) the disturbance of approximately 757 acres of alluvial fan, and (3) the extraction of an additional 860,000 ounces of gold from unoxidized ore from the geologic resource. Under the proposed action, these direct impacts would not be mitigated. Potential water quality impacts from the tailings facility are addressed in Section 3.2, Water Resources.

Existing geologic information and condemnation drilling results indicate there are no known mineral resources beneath the footprint of the proposed tailings facility; therefore, placement of these materials should not inhibit future attempts to recover minerals in this area. No active or potentially active faults are located in the near vicinity of the proposed facilities. A stormwater diversion system would be located upgradient from the facility; thus, potential impacts from periodic debris flow or flooding from Kelsey Canyon are not anticipated.

Other indirect impacts from the proposed action, including the potential for damage to the tailings facility from seismically induced slope instability and liquefaction and from settlement and deformation, are addressed below.

Tailings Embankment Stability. The features and construction approach to the mill and tailings facilities are presented in the Description of the Proposed Action and the Alternatives (Chapter 2) of this document. In general, the tailings embankment and impoundment would be built using a phased approach, and would ultimately consist of two cells over a liner and fluid collection system.

Seismic design parameters, slope stability analysis, and geotechnical design of the tailings facility were prepared by SHB AGRA (1994b). The stability of the tailings facility was evaluated for both the operational basis earthquake, defined as an earthquake with an estimated average recurrence interval of 100 years or a probability of exceeding 0.01 in any given year, and the maximum credible earthquake, defined as the largest earthquake that could conceivably occur given the existing tectonic regime. The tailings facility has been designed to remain functional with no more than repairable damage under the operational basis earthquake and to prevent excessive deformation or collapse during the maximum credible earthquake.

Various potential failure scenarios of the proposed embankment were investigated by standard analysis procedures using data collected on the site (SHB AGRA 1994b). Static and pseudostatic analyses were performed. For the operational basis earthquake, results indicate that factors of safety above 1.0 (minimum value) were determined for critical sections in all potential failure modes. The effects of operational basis earthquake seismic loading on embankment performance would be minimal with adequate design and construction quality control.

Pseudostatic analyses were performed to estimate permanent embankment deformations from the maximum credible earthquake and the operational basis earthquake. The analyses indicate that permanent deformation is not anticipated to occur during the operational basis earthquake. Permanent deformation of 9 to 33 inches would result from the maximum credible earthquake. Damage from such an extreme event may cause enough movement at the embankment toe to damage the synthetic liner. The potential for impacts from such an occurrence are considered minimal given the anticipated infrequency of an event (estimated recurrence interval of 10,000 years) and the drained conditions at the facility as discussed below.

Published case histories (Seed 1983, Seed et. al. 1978) indicate that rockfill dams similar to the proposed embankment can withstand moderate to extreme seismic shaking with little or no damage or deformation. The same was found for well-built dams on adequate foundations using other materials, as long as the dam materials were kept dry. This assumption is probably valid for operational conditions at the project site because of the inclusion of an underdrainage system and the generally porous, well-drained nature of the proposed embankment materials. Liquefaction of the embankment and foundation materials is unlikely because of dry conditions and the soil mechanics properties of the materials.

In summary, these analyses indicate that potential environmental impacts from seismic effects on the tailings facility are anticipated to be minimal over

both the short and long terms. The stability analyses were conducted for conservative conditions with regard to construction and operations. A period of several years would be required after operations to allow the facility to drain and to dispose of the drained fluids. The postclosure drainage configuration, low precipitation amounts, and high evaporation rates would minimize collection and infiltration of meteoric water. Over the long term, the embankment should be adequately stable because of its initial design and construction and the drained condition of the facility.

Tailings Settlement and Deformation. Deformation and settlement analyses were conducted for the proposed embankment (SHB AGRA 1994b). From these analyses, it was determined that a maximum settlement of approximately 16 inches could occur at the middle of the embankment cross section. Horizontal strains on the liner were also studied. These analyses indicate that settlement and deformation should not adversely affect embankment integrity and operation of the facility.

It should be noted that construction quality assurance and a monitoring and instrumentation program are recommended as part of the tailings facility development (SHB AGRA 1994b). Assuming proper construction quality and implementation of a monitoring program, no significant geologic hazard-related impacts are anticipated.

3.1.2.2 Range Management Alternative

The geology and minerals impacts associated with the range management alternative would be similar to the proposed action.

3.1.2.3 Tailings Impoundment Alternative

The geology and minerals impacts associated with the tailings impoundment alternative would be similar to the proposed action.

3.1.2.4 No Action Alternative

Under this alternative, the proposed mill and tailings facility would not be constructed. The unoxidized ore would be processed along with the oxidized ore in the previously permitted heap-leaching circuit. Approximately 36 percent of the gold would be recovered compared to the expected recovery of 85 percent with the proposed mill and tailings facility. This would eliminate the recovery of approximately 860,000 ounces of gold (Veek 1995). Without the proposed mill, only ore with a higher cutoff grade would be put on the heap; lower grade ore would be left in the ground or placed in a waste rock pile.

3.1.3 Cumulative Impacts

Surface mining activity affects geology and mineral resources through excavating, modifying, or covering natural topographic and geomorphic features and by removing mineral deposits. The study area for the cumulative impact analyses for geology and mineral resources includes the five identified mineralized districts of Round Mountain, Manhattan, Gold Hill, Jefferson Canyon, and Barcelona. These districts are described in Section 2.5.1, Past and Present Actions; their locations and approximate areal extents are shown in ***Figure 2-9***.

Mining disturbance has included open pit and underground mining, waste rock disposal, heap leaching, ore milling and processing, tailings disposal, placer operations, and exploration (road construction and drill pads). Production in these districts has included gold, silver, antimony, mercury, and lead. Aerial photographs of the region indicate that most of the mining disturbance occurs in the five identified districts, and that most land within these districts has been disturbed by past mining activity. The cumulative area of disturbance was estimated by planimetering the area within each identified mining district shown in ***Figure 2-9***. The estimated cumulative area affected by past mining activity is estimated at 9,451 acres. The proposed action would create approximately 757 acres of additional disturbance, and the possible future dedicated leach pads at the Round Mountain Mine would disturb approximately 290 acres; therefore, implementation of the proposed action and reasonably foreseeable future actions at the site would increase the total disturbed acreage in this area by approximately 11 percent.

Because gold mining is a major activity in this area, it is reasonable to assume that large-scale mining will continue and will result in the creation or expansion of open pits, waste rock disposal areas, heap-leach pads, and tailings facilities in the foreseeable future. Considering the current level of activity in the district, it is reasonably foreseeable that in addition to the proposed action, the mining

in this area could expand the acreage of disturbance by another 10 to 15 percent in the next decade.

3.1.4 Monitoring and Mitigation Measures

Potential impacts to geology and minerals would be minimized by reclamation practices included as part of the proposed action (see Section 2.3.6, Reclamation). No additional measures are recommended for geology and minerals.

3.1.5 Residual Adverse Effects

Residual adverse effects associated with the proposed action and the alternatives would include the generation and permanent disposal of 57 million tons of tailings and the disturbance of approximately 757 acres of alluvial fan. Under the proposed action, these direct impacts would not be mitigated.

3.2 Water Resources

3.2.1 Affected Environment

3.2.1.1 Surface Water

Hydrologic Setting. The proposed mill and tailings facilities are situated at the base of the Toquima Range in the northern portion of the Big Smoky Valley. This hydrographic area is a topographically closed basin relative to surface water flows and is separated from the southern part of the Big Smoky Valley by a low alluvial divide (Rush and Schroer 1971). The project area is located north of and near this divide. The northern part of the closed basin trends generally north-south, occupying approximately 1,400 square miles in a long, narrow watershed bounded by the Toquima and Toiyabe ranges. Mean annual precipitation in the region ranges from approximately 6 inches on the valley floor to 20 inches or more in the higher mountains. Most of the precipitation at higher elevations accumulates as snow during the winter (Rush and Schroer 1971). Mean annual free water surface evaporation (e.g., from a shallow lake) is estimated at 50 to 56 inches (PTI 1995).

Within this northern part of the Big Smoky Valley, the project area lies within a smaller hydrographic basin that occupies approximately 350 square miles, as shown in ***Figure 3-5***. This area occurs at the southern extreme of the northern Big Smoky Valley and is bounded by the Toquima Range on the east, the Toiyabe Range on the west, and by low topographic divides on alluvial fan surfaces and the valley floor.

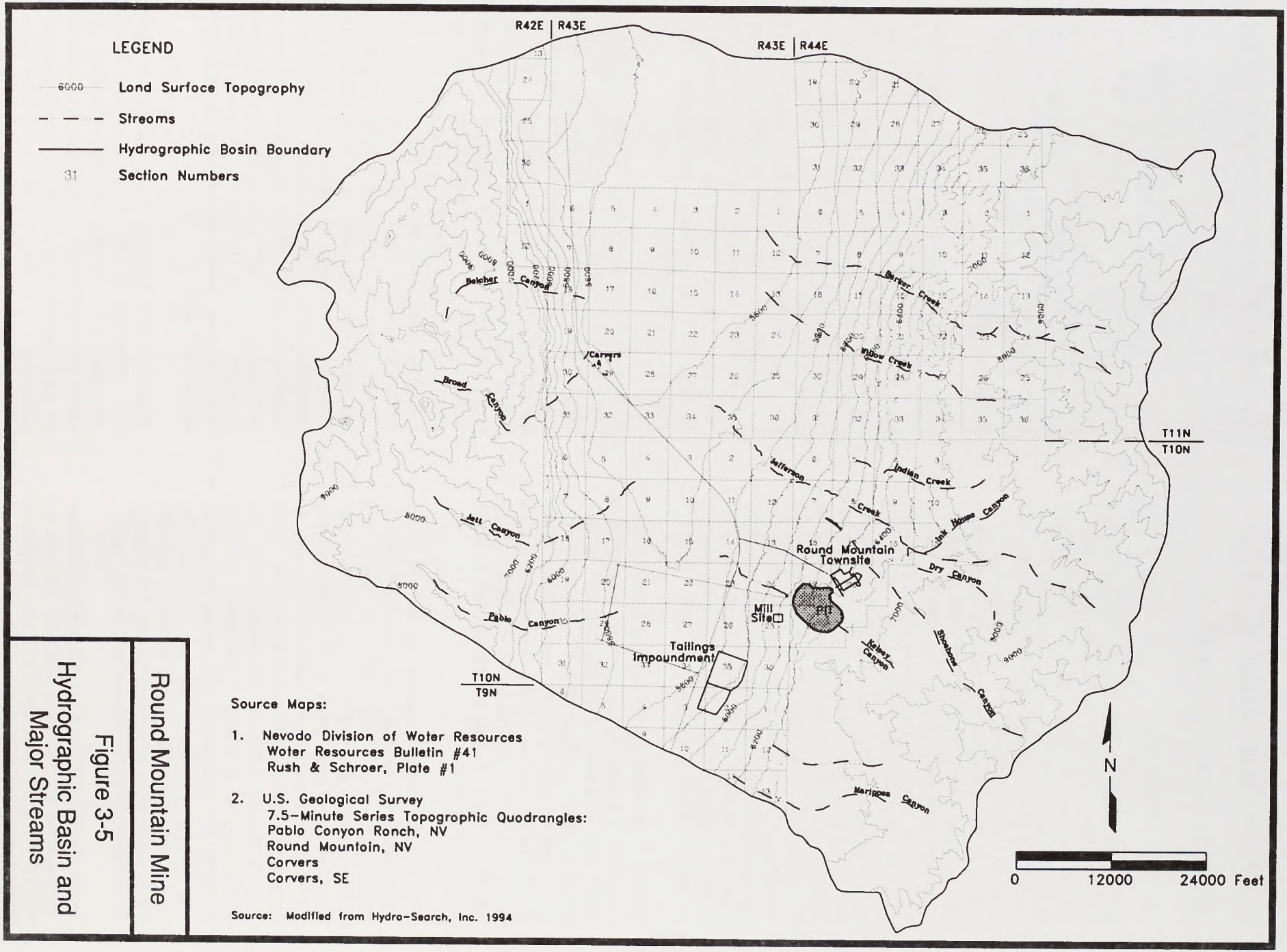
The surface drainage system consists of steep, rocky canyons that open into shallow, dispersive patterns typical of alluvial fans in the Big Smoky Valley. Streams are confined to bedrock-controlled channels in the upper parts of the watersheds that act as source areas for runoff and sediment. As the streams leave the mountain front, broad, gently sloping alluvial fans are deposited under arid conditions. As a result, streamflows generally disperse into numerous small, shallow, gravel-lined channels and infiltrate the fan surfaces. The natural ephemeral channels in the region generally fail to show signs of confluence with the drainage in the valley floor (JBR Consultants Group 1988).

Some streams that drain the surrounding mountain ranges have intermittent to perennial reaches, but most drainages in the project area are classified as ephemeral, flowing only in response to precipitation events and snowmelt runoff. Major drainages from the Toiyabe Range include Belcher Canyon, Broad Canyon, Jett Canyon, and Pablo Canyon. These canyons drain to the valley floor north and west of the project site, and would not be affected by project activities. Several major drainage basins originating in the Toquima Range occur in the immediate vicinity of the project site and proposed expansion: Jefferson Canyon, Shoshone Canyon, Kelsey Canyon, and Mariposa Canyon. Watersheds pertinent to the project components are shown in ***Figure 3-6***.

Surface Water Inventory. A baseline reconnaissance of springs, seeps, and streams within a 5-mile radius of the project site was conducted during late August 1994 (Hydro-Search, Inc. 1994b). The purpose of the study was to define the location, flow, and water quality of existing springs, seeps, and streams in the vicinity of the project site. The inventory included flow rates, indicator water quality parameters (temperature, pH, specific conductance, dissolved oxygen), and geologic conditions (***Table 3-4***). The study area and locations of flowing stream reaches and springs are shown in ***Figure 3-7***.

A review of U.S. Geological Survey topographic maps located 13 springs within the inventory area (***Figure 3-7*** and ***Table 3-4***). The majority occur in the upper reaches of Shoshone Canyon outside the project area and flow intermittently. Only 4 of the 13 spring locations contained any water at the time of the field inventory. The two primary springs observed were Ink House and Healy. Water from these two springs is captured and piped to the Round Mountain townsite as a supplement to well water for public water supply (Hydro-Search 1994b). These springs are periodically sampled as required for drinking water sources by the State of Nevada. Two springs in Shoshone Canyon also contained water: upper Shoshone #2 (SP13) and upper Shoshone #1 (SP31). An observable flow of approximately 0.1 gallon per minute was observed at upper Shoshone #2. Upper Shoshone #1 had stagnant water ponded on the ground surface with no apparent flow.

Eleven stream channels were visited, of which four contained flowing reaches (Indian Creek, Slaughterhouse Canyon, Jefferson Canyon, and upper Shoshone Canyon) (***Figure 3-7***). A flow rate of approximately 5 to 10 gallons per minute was estimated for a section of the Indian Creek



Source Maps:

1. Nevodo Division of Woter Resources
   Woter Resources Bulletin #41
   Rush & Schroer, Plate #1

2. U.S. Geological Survey
   7.5-Minute Series Topogrophic Quodrangles:
   Pablo Conyon Ronch, NV
   Round Mountoin, NV
   Corvers
   Corvers, SE

Source: Modified from Hydro-Search, Inc. 1994

Round Mountain Mine

Figure 3-5
Hydrographic Basin and Major Streams

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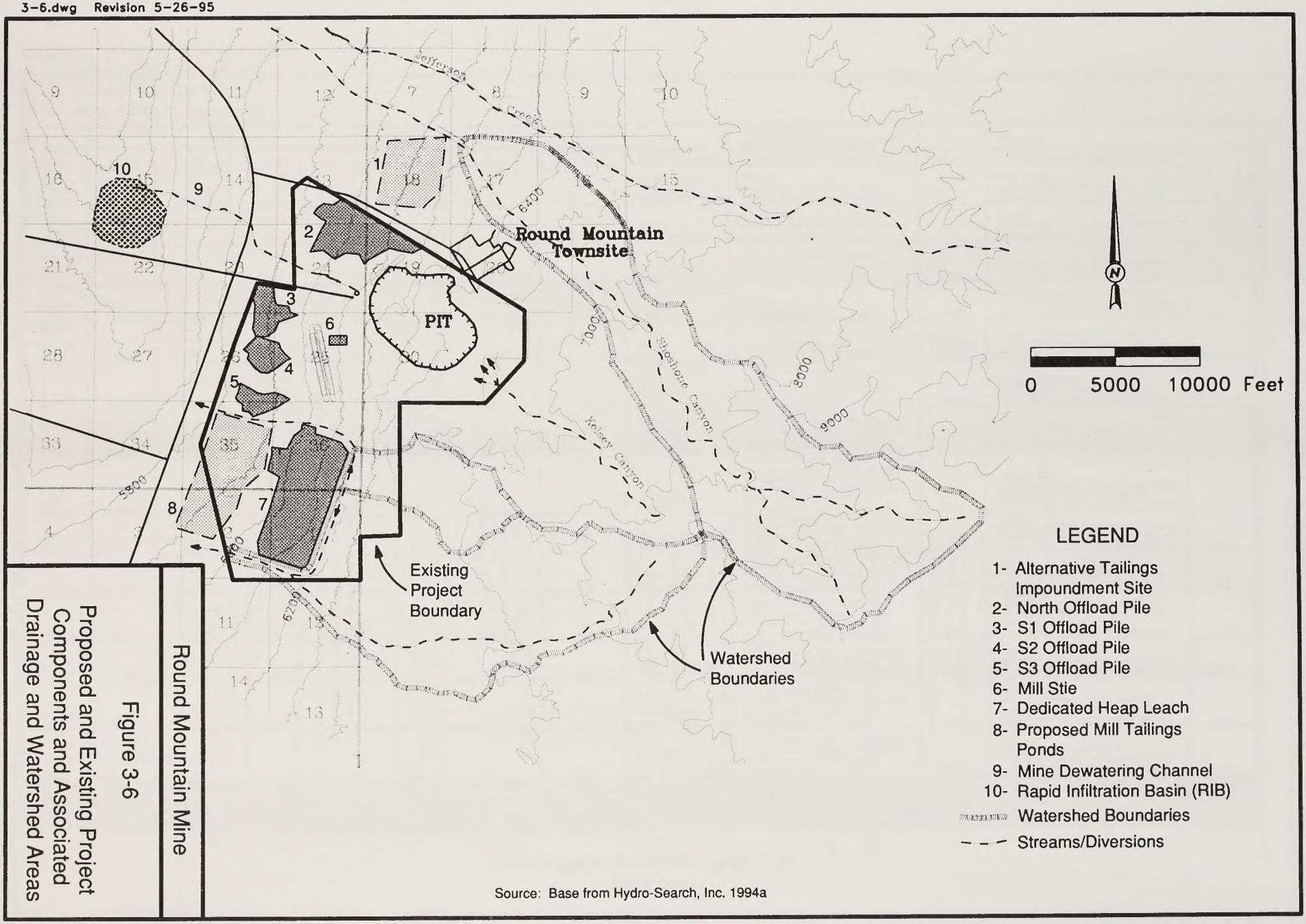


Source: Base from Hydro-Search, Inc. 1994a

Round Mountain Mine

Figure 3-6

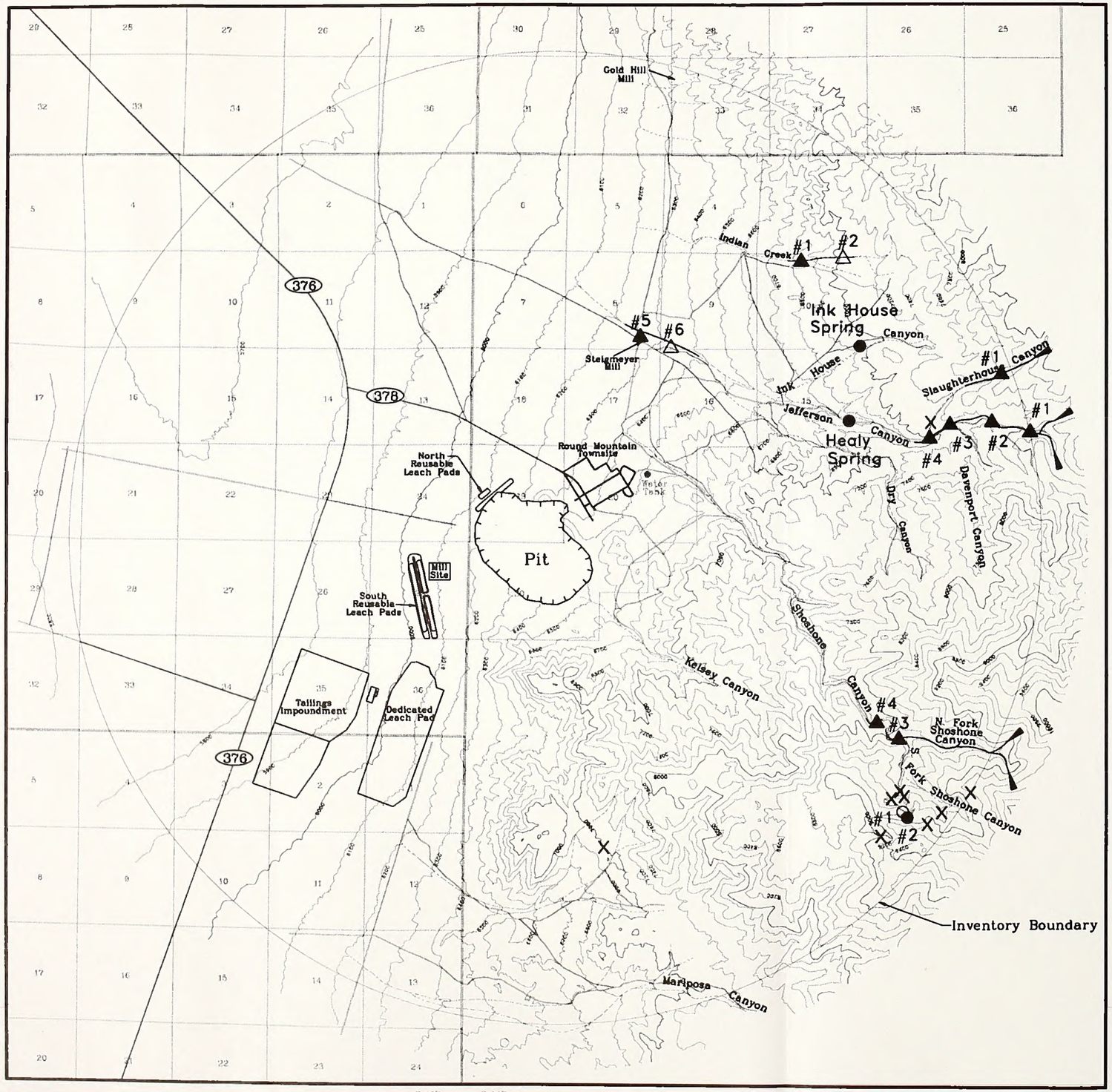
Proposed and Existing Project Components and Associated Drainage and Watershed Areas

TABLE 3-4
Surface Water Inventory Field Data

Sample Point	Sample Date	Elevation	Flow Rate (gpm)	Temperature (°F)	pH	Specific Conductance (µmhos/cm)	Dissolved Oxygen (mg/L)	Geomorphic Setting	Geologic Unit/Control	Water Source	Comments	Water Quality Sample
Indian Creek #1	9/1/94	6,820	6	54	7.7	301	6.96	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derivad from Tertiary volcanics from the Toquima caldera; volcanic outcrops on hillsides.	Stream	Undeveloped; sample point approximately 400 feet north of road along cattle crossing through the creek; trees flagged.	Yes
Indian Creek #2	9/1/94	7,000	5 to 10 (est.)	56	7.9	247	8.17	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics from the Toquima caldera; volcanic outcrops on hillsides.	Stream	Undeveloped; sample point approximately 1,000 feet north of road; should cross a dry shallow drainage before the site; trees flagged.	No
Slaughter-house #1	8/31/94	7,440	21	57	8.2	151	7.50	Mountain stream channel bottom	Cobbles and other sediments derived from Tertiary Volcanics from the Toquima caldera; volcanic outcrops on hillsides.	Stream	Undeveloped; sample point at primitive camp site along north edge of road; trees flagged.	Yes
Jetterson #t	8/30/94	7,280	73	55	7.9	239	7.30	Mountain stream channel bottom	Rock-lined channel and cobbles with other sediments, most of which are Tertiary volcanics from the Toquima caldera; minor intrusive cobbles.	Stream	Undeveloped; sample point along south edge of Jefferson Canyon road, approximately 600 feet down slope of the Wild Horse Canyon road junction; trees flagged.	Yes
Jefferson #2	8/30/94	7,180	56	56	7.9	202	7.55	Mountain stream channel bottom	Cobble-lined channel with other sediments, most of which are of intrusive origin; probably derived from Cretaceous Granite; minor metamorphic.	Stream	Undeveloped; sample point at upstream edge of road crossing; flow measured at downstream edge; trees flagged.	Yes
Jefferson #3	8/30/94	7,100	43	58	7.8	220	7.41	Mountain stream channel bottom	Cobble-lined channel with other sediments, most of which are of intrusive origin; probably derived from Cretaceous Granite; minor metamorphic.	Stream	Undeveloped; sample point approximately 100 feet northwest of Jefferson Canyon and Davenport Canyon road junction; vegetation flagged.	Yes
Jefferson #4	8/30/94	6,980	t5	78	8.7	250	6.26	Mountain stream channel bottom	Cobble-lined channel with other sediments that are of intrusive and volcanic origin; probably derived from Cretaceous Granite and Tertiary volcanics from the Toquima caldera; volcanic outcrops on hillsides.	Stream	Undeveloped; sample point approximately 200 feet east of junction of Jefferson Canyon and Slaughterhouse Canyon roads; vegetation flagged.	Yes
Jefferson # 5	8/31/94	6,240	15	74	8.8	262	6.44	Stream channel bottom within alluvial fan; channel within a larger flood plain	Cobble-lined channel and sandy banks of Quaternary alluvium derived from Tertiary volcanics possibly from the Toquima caldera and from intrusive rock from the Cretaceous Granite.	Stream	Undeveloped; sample point approximately 20 feet upstream of road crossing; vegetation flagged.	Yes
Jefferson #6	8/31/94	6,320	66	61	8.3	3t1	7.65	Stream channel bottom within alluvial fan; channel within a larger flood plain	Cobble-lined channel and sandy banks of Quaternary alluvium derived from Tertiary volcanics possibly from the Toquima caldera and from intrusive rock from the Cretaceous Granite.	Stream	Undeveloped; sample point approximately 300 feet north of road; path through vegetation flagged.	No
Upper Shoshone #1 (Spring)	8/29/94	8,800	0	---	---	---	---	Hillside	Originating from tractures in the Cretaceous Granite.	Spring (stagnant)	Undeveloped; soil was wet; water ponded on surface; excavated a portion of the hillside with a shovel; no flow occurred. site not staked.	No
Upper Shoshone #2 (Spring)	8/29/94	8,920	0.t	53	6.6	101	7.94	Hillside	Originating from fractures in the Cretaceous Granite.	Spring	Developed at one time for cattle; pipeline in disrepair; sample point within barbed wire enclosure 20 feet above road; vegetation flagged.	Yes
Upper Shoshone #3	8/29/94	8,040	13	63	8.0	125	6.74	Mountain stream channel bottom.	Cobble-lined channel with other sediments that are of intrusive origin; derived from Cretaceous Granite.	Stream	Undeveloped; sample point at upstream edge of road crossing; vegetation tlagged	Yes
Shoshone #4	8/29/94	7,800	8	60	7.2	163	6.78	Mountain stream channel bottom	Cobble-lined channel with other sediments that are of intrusive origin; derived from Cretaceous Granite.	Stream	Undeveloped; sample point approximately 50 feet north of flag at roadside; vegetation tlagged.	Yes
Ink House Spring	10/4/94	6,920	t0-12	---	---	---	---	Hillside adjacent to dry mountain stream channal	Originating from volcanics; probably from the Tertiary Toquima caldera complex.	Spring	Developed, collected, contained, and piped to the Round Mountain townsite for public water supply.	Yes
Healy Spring	10/4/94	6,720	18-20	---	---	---	---	Hillside adjacent to mountain stream channel	Originating from Quaternary alluvium; probably derived from Cretaceous Granite and Tertiary volcanics from the Toquima caldera.	Spring	Developed, collected, contained, and piped to the Round Mountain townsite for public water supply.	Yes

Notes: gpm = gallons per minute
µmhos/cm = micormhos
mg/L = miligrams per liter

Source: Hydro-Search, Inc. 1994b



LEGEND

- 376 — State Route
- Secondary Paved Roads
- Dirt Roads
- Stream Channel Reaches with No Observed Flow
- Stream Channel Reaches with Observed Flow
- Indicates Stream Flow Observed From Channels Outside the 5-Mile Radius
- #1 ▲ — Stream locations sampled for laboratory analysis
- #2 △ — Stream locations where only field parameter and flow data were collected
- #2 ● — Inventoried spring or seep that was sampled for laboratory analysis
- #1 ○ — Inventoried spring or seep where only field parameter data or no data was collected
- X — Dry Spring previously identified by the U. S. Geological Survey
- Land Surface Topography (100-foot intervals Below 7000 feet,msl and 200-foot intervals Above 7000 feet,msl)
- 36 — Section Numbers

Source Maps:
U. S. Geological Survey
7.5-minute Topographic Quadrangles:
Pablo Canyon Ranch, NV
Round Mountain, NV
Carvers
Carvers, SE

N

0 0.5 1 Mile

Note: See Table 3-4 and 3-6 for field and water quality data.

Source: Modified from Hydro-Search, Inc. 1994

Round Mountain Mine

Figure 3-7

Surface Water Inventory Map

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drainage approximately 4,000 feet long. The drainage was dry both upstream and downstream of the flowing section. The flow rate in Slaughterhouse Canyon was measured at 21 gallons per minute at the 5-mile radius boundary, but became dry approximately 1,900 feet downstream.

Portions of the streams located in upper Shoshone and upper Jefferson canyons upgradient of the proposed project facilities exhibited perennial flow, primarily as a result of discharge from the springs described previously (***Figure 3-7***). Two separate channel reaches in Jefferson Canyon exhibited flow. In the upper section of Jefferson Canyon, a maximum flow of 73 gallons per minute was observed near the 5-mile radius boundary. The stream went dry just downstream of the confluence of the Jefferson and Slaughterhouse drainages. Flow was also observed in an approximately 1-mile long section of Jefferson Canyon in the area on the alluvial fan near the Steigmeyer Mill. This reach had a maximum flow of 66 gallons per minute. No flow was observed between the upper and lower flowing reaches of Jefferson Canyon. Near the 5-mile radius boundary on the North Fork of Shoshone Canyon, a flow rate of 13 gallons per minute was observed. The flow in Shoshone Canyon continued for approximately 1 mile downstream from the study boundary.

In the vicinity of the proposed tailings impoundment, the stream channels exhibit a distributed depositional pattern typical of smaller drainages and fans in the area. Also similar to common regional conditions, the runoff from the small drainages east of the proposed tailings impoundment is limited to short durations after high-intensity storms or rapid snowmelt. When flow does occur in these ephemeral drainages in the project vicinity, runoff normally disperses and infiltrates the alluvial fans or is diverted by drainage structures on the site before it reaches the valley floor. The proposed tailings impoundment would be generally isolated from runoff from upgradient areas by the existing project features (notably the dedicated heap leach). No major surface water bodies naturally occur downgradient of the proposed facilities, although a mine discharge stream drains from the dewatering site to a rapid infiltration basin on the valley floor (***Figure 3-6***).

The alternative tailings impoundment is located near the head of the alluvial fan at Shoshone Canyon. Natural trenching at the heads of the fans has defined dominant stream channels in the larger watersheds at several locations, notably at Shoshone Canyon, Jefferson Canyon, and other channels farther north. Depending on bedrock exposures, flow and sediment load, and other geomorphic controls at the fan head, the locations of such channels may shift over time.

The proposed mill site and associated process solution pipelines would be located in upland areas away from stream channels. Similar to the proposed tailings facility, the proposed mill and associated features would be generally isolated from major runoff events by their topographic setting and by existing upgradient project components.

Flood Hydrology. During preparation of this EIS, flood hydrology was modeled for both the proposed and alternative tailings impoundment sites using methods developed by the Soil Conservation Service (1972). A 100-year, 6-hour storm and a 100-year, 24-hour storm were modeled at both locations using precipitation inputs developed for the area (Miller et al. 1973). Watershed conditions were modeled to reflect the generally shallow, high runoff soil conditions and sparse vegetation occurring in the area. The resulting simulated hydrographs reflect estimated conditions for a 100-year storm event at watershed outlets or along diversion ditches near the proposed and alternative tailings impoundments.

Modeling results are shown in ***Table 3-5***. These results indicate that lower volumes and peak discharges occur for both the 6-hour and 24-hour events at the proposed tailings facility when compared to those for the alternative. The 24-hour events typically generate the largest runoff peaks and volumes.

Surface Water Quality Standards. Waters of the State of Nevada are defined in the Nevada Revised Statutes, Chapter 445, Section 445.191, "Waters of the State Defined," and include but are not limited to (1) all streams, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems, and drainage systems; and (2) all bodies or accumulations of water, surface and underground, natural or artificial.

Water quality standards for state waters have been established by the State of Nevada under Nevada Administrative Code, Chapter 445, Sections

TABLE 3-5
Flood Hydrology

Watershed	Watershed Area (mi^2)	Runoff Event	Precipitation Depth (inches)	Estimated Runoff Volume (acre-feet)	Estimated Peak Flow (cfs)
South Watershed Proposed Tailings Impoundment	6.0	10 yr - 6 hr	1.2	14	56
		10 yr - 24 hr	1.8	61	190
		100 yr - 6 hr	1.6	41	155
		100 yr - 24 hr	2.4	148	600
North Watershed, Proposed Tailings Impoundment	1.5	10 yr - 6 hr	1.2	4	19
		10 yr - 24 hr	1.8	18	70
		100 yr - 6 hr	1.6	13	51
		100 yr - 24 hr	2.4	40	190
Alternative Tailings Impoundment	8.2	10 yr - 6 hr	1.5	79	354
		10 yr - 24 hr	2.0	206	960
		100 yr - 6 hr	2.1	205	1,230
		100 yr - 24 hr	2.9	439	2,200

Notes: cfs - cubic feet per second
mi^2 - square miles
ac ft - acre feet
Source: Miller et al. 1973, Riverside Technology, inc.

445.117 through 445.13976, Standards for Water Quality. Water quality criteria to protect the beneficial uses of perennial surface waters within the project region (Jett Creek, South Fork Twin River, and Peavine Creek) and their tributaries are prescribed in the Nevada Administrative Code, Chapter 445, Section 445.117, Criteria for Water Quality for Designated Beneficial Uses; Section 445.119, Standards Applicable to all Waters; Section 445.120, Standards Applicable to Beneficial Uses; and Section 445.122, Class A Waters. Narrative water quality standards for protecting intermittent and ephemeral surface waters in the project area are prescribed in the Nevada Administrative Code, Chapter 445, Section 445. 119, Standards Applicable to All Waters.

However, since intermittent and ephemeral surface waters in the project area often recharge ground water systems used as drinking water sources, numeric water quality criteria for drinking water were used to evaluate these surface waters. These criteria include federal primary and secondary maximum contaminant levels, Nevada primary maximum contaminant levels, and Nevada enforceable secondary maximum contaminant levels. Primary maximum contaminant levels are established to protect human health from potentially toxic substances in drinking water, while secondary maximum contaminant levels are established to protect aesthetic qualities of drinking water, such as taste, odor, and appearance. The State of Nevada also has adopted enforceable secondary maximum contaminant levels derived from the federal secondary maximum contaminant levels.

Surface Water Quality. Historical data for the Big Smoky Valley indicate that surface water quality conditions vary between low flow periods when ground water seepage constitutes the principal source of flow and high flow periods fed by snowmelt and runoff (Rush and Schroer 1971). Available data from Rush and Schroer (1971) characterize surface waters in the valley as a calcium bicarbonate type with specific conductance values ranging from 94 to 500 micromhos per centimeter at 25°C (total dissolved solids concentration in milligrams per liter is generally 55 to 70 percent of the specific conductance in micromhos per centimeter at 25°C). Where flows are more influenced by ground water discharge, higher total dissolved solids concentrations and a sodium and chloride influence on water type were observed (Rush and Schroer 1971).

More recent water quality data are available for selected surface water sites and springs within a 5-mile radius of the project site from a surface water inventory conducted by Hydro-Search, Inc. (1994b). Sampling sites from the baseline reconnaissance of streams and springs are identified in ***Figure 3-7***. Water quality results for surface waters and springs sampled during the inventory are presented in ***Table 3-6***. Streams included in the inventory were generally a calcium-sodium bicarbonate type with pH ranging from 7.2 to 8.9

TABLE 3-6
Surface Water Quality

Sample Point	Units	Maximum Contaminant Level	Indian Creek #1	Slaughter-house #1	Jefferson #1	Jefferson #2	Jefferson #3	Jefferson #4	Jefferson #5	Upper Shoshone #2 (Spring)	Upper Shoshone #3	Shoshone #4	Ink House Spring	Healy Spring
Date	—	---	9/1/94	8/31/94	8/30/94	8/30/94	8/30/94	8/30/94	8/31/94	8/29/94	8/29/94	8/29/94	10/4/94	10/4/94
Alkalinity	mg/L as $CaCO_3$	---	129	60	59	60	66	62	96	28	44	60	161	103
Aluminum	mg/L as Al	(0.05 - 0.2)[3]	0.054	0.096	<0.025	0.026	<0.025	0.051	0.093	<0.025	<0.025	<0.025	<0.025	0.031
Arsenic	mg/L as As	0.05[2]	<0.005	<0.005	**0.20**	0.017	0.017	0.016	0.0099	<0.005	<0.005	<0.005	<0.005	0.0070
Barium	mg/L as Ba	2.0[2]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate	mg/L as HCO_3	---	157	73	72	73	80	71	112	34	54	73	196	126
Cadmium	mg/L as Cd	0.005[2]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Calcium	mg/L as Ca	---	25	10	20	17	20	22	27	5.5	13	15	36	35
Carbonate	mg/L as CO_3	---	0	0	0	0	0	2	2	0	0	0	0	0
Chloride	mg/L as Cl	250[3] - 400[1]	5.4	2.2	2.6	2.4	2.7	3.0	3.4	1.8	1.2	2.4	6.3	3.1
Chromium	mg/L as Cr	0.1[2]	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Color	color units	15[1]	15-20	5-10	5-10	15-20	10-15	10-15	5-10	0-5	10-15	30-35	5-10	5-10
Copper	mg/L as Cu	1.3[1]	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Dissolved Oxygen	mg/L as O_2	---	6.96 F	7.50 F	7.30 F	7.55 F	7.41 F	6.26 F	6.44 F	7.94 F	6.74 F	6.78 F	---	---
Fluoride	mg/L as F	2.0[1] - 4.0[2]	0.27	0.13	0.29	0.28	0.32	0.32	0.34	0.10	0.36	0.46	0.25	0.26
Hardness	mg/L as $CaCO_3$	---	81	28	64	51	65	70	81	15	31	43	111	100
Iron	mg/L as Fe	0.3[3] - 0.6[1]	0.070	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.068	<0.05	<0.05
Lead	mg/L as Pb	0.015[1]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Magnesium	mg/L as Mg	150[1]	4.6	1.4	3.4	2.8	3.1	3.5	3.8	1.2	1.1	1.6	5.7	3.8
Manganese	mg/L as Mn	0.05[3] - 0.1[1]	**0.11**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	**0.083**	<0.03	<0.03
Mercury	mg/L as Hg	0.002[2]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate	mg/L as N	10.0[2]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nitrite	mg/L as N	1.0[2]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH	standard units	(6.5 - 8.5)[1]	7.7 F 8.0 L	8.2 F 8.0 L	7.9 F 7.7 L	7.9 F 7.7 L	7.9 F 7.7 L	**8.7** F 8.4 L	**8.9** F 8.4 L	6.6 F 6.9 L	8.0 F 7.5 L	7.2 F 7.5 L	7.7L	7.7L
Potassium	mg/L as K	---	<1	<1	1.0	<1	1.1	1.3	1.0	<1	<1	1.3	1.1	<1
Selenium	mg/L as Se	0.05[2]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	mg/L as Ag	0.1[3]	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Sodium	mg/L as Na	---	25	15	15	17	18	17	17	7.8	6.7	9.1	30	13
Specific Conductance	µmhos/cm	---	301 F	151 F	239 F	202 F	220 F	250 F	262 F	101 F	125 F	163 F	---	---
Sulfate	mg/L as SO_4	250[3] - 500[1]	5.9	5.2	38	29	33	38	22	5.1	5.5	<5	13	24
Total Dissolved Solids	mg/L	500[3] - 1000[1]	188	106	142	140	160	172	182	74	87	102	272	194
Temperature	°F	---	54	57	55	56	58	78	74	53	63	60	---	---
Turbidity	NTU	0.5[2]	**1.1**	**1.8**	**1.2**	**1.0**	**0.57**	**0.81**	0.26	0.23	0.35	**2.2**	0.10	0.29
Zinc	mg/L as Zn	5.0[1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Values in bold type exceed applicable maximum contaminant levels.
Source: Hydro-Search, Inc. 1994b

mg/L - miligrams per liter
F = Field measurement
L = Laboratory measurement
NTU = Nephelometric turbidity unit

(1) Nevada Secondary Enforceable maximum contaminant level
(2) Nevada Primary maximum contaminant level
(3) Federal secondary maximum contaminant level

standard units and total dissolved solids ranging from 87 to 188 milligrams per liter. Sample results indicate that water from the springs was generally a calcium-sodium bicarbonate type, with a pH ranging from 6.6 to 7.7 standard units and total dissolved solids values ranging from 74 to 272 milligrams per liter.

Results from surface water sampling during the Hydro-Search, Inc. (1994b) surface water inventory indicate that, with a few exceptions, the water from the stream sites sampled met federal and state primary maximum contaminant levels for all water quality parameters analyzed. The standard of 0.5 nephelometric turbidity unit for turbidity was exceeded at seven sample points with values ranging from 0.57 to 2.2 nephelometric turbidity units. The standard of 0.05 milligram per liter for arsenic was exceeded at Jefferson #1 where a value of 0.20 milligram per liter was reported. At Indian Creek #1, a reported value of 0.11 milligram per liter for manganese slightly exceeded the standard of 0.1 milligram per liter (***Table 3-6***). Results of samples taken from springs met federal and state primary and secondary maximum contaminant levels for all water quality parameters analyzed.

3.2.1.2 Ground Water

Hydrogeologic investigations have been conducted to provide background information for the EIS and to comply with Nevada Division of Environmental Protection permit requirements. These studies include soil, leach residue, and ground water sampling to evaluate the leach offload piles, (WESTEC 1991); investigations of soil and ground water conditions in the vicinity of the leach offload piles (Hydro-Search, Inc. 1993, 1994a); investigations of the soil and ground water conditions in the vicinity of the proposed tailings impoundment (SHB AGRA 1994b); a hydrogeologic investigation to support ground water flow modeling to simulate mine dewatering and pit lake development (Hydro-Search, Inc. 1994c); and geochemical modeling to predict pit lake water quality (PTI 1995). These investigations have defined the hydrogeologic and geochemical conditions in the hydrographic basin and beneath the project site.

Recharge, storage, and movement of ground water is dependent on the geologic conditions. The lithologic and structural conditions in the vicinity of the project are complex, as described in Section 3.1, Geology and Minerals. Ground water occurs in bedrock units that underlie the area and in basin fill alluvium. In bedrock, the recharge, storage, flow, and discharge of ground water is controlled by the porosity, permeability, and structure (i.e., fault and fracture zones) of the geologic materials. In alluvium, the ground water is stored and transmitted through interconnected pores within the unconsolidated sediments. Principal hydrostratigraphic units in the region include (from oldest to youngest): (1) Paleozoic metasedimentary rocks and Cretaceous intrusive rocks that form the basement bedrock, (2) Tertiary volcanic rocks, and (3) Quaternary alluvium that partially fills the Big Smoky Valley. The general distribution of these units is presented in ***Figures 3-1*** and ***3-2***.

Basement Bedrock. Paleozoic metasedimentary rocks and Cretaceous granitic rocks form the basement assemblage throughout the region. These rocks are exposed in the Toquima and Toiyabe Ranges and underlie the volcanic and alluvial deposits in the Big Smoky Valley. Paleozoic rocks consist of highly folded thrust sheets composed of several lithologic groups, including quartzite and phyllite, argillite and schist, and limestone. The Paleozoic rocks have been intruded by a series of granitic stocks. Ground water within the basement rocks is generally confined; water in these rocks is stored and transmitted through a system of interconnected fractures or fracture networks. Because of the broad variation of rock types and the complex pattern of fracturing, the hydraulic properties of this unit are inferred to be highly variable across the area.

No aquifer test data are available for the Paleozoic metasediments or granitic rocks in the vicinity of the project site. However, aquifer tests have been performed in similar Paleozoic metasedimentary rocks near the Manhattan Mine located approximately 9 miles south of the project area. Transmissivity is a measure of the ability of the rock to transmit water. As shown in ***Table 3-7***, an analysis of the aquifer tests yielded moderately high transmissivities ranging from 10,000 to 30,000 gallons per day per foot depending on rock type. The tests also indicated that these materials were highly compartmentalized (Hydro-Search, Inc. 1984, 1988).

Tertiary Volcanics. Tertiary volcanics consist of a series of silicic pyroclastic rocks, predominantly ash-flow tuffs, associated with four identified calderas located within the Toquima Range and the eastern margin of the Big Smoky Valley (see

TABLE 3-7
Summary of Aquifer Tests

Hydrostratigraphic Unit	Well(s)	Test Duration (hours)	Saturated Thickness (ft)	Pump Rate (gpm)	Transmissivity (gpd/ft)
Alluvium (alluvial fan at project site)	Test wells (immediately west of pit)	96	150-242	63	6,700-28,000
Alluvium (basin fill alluvium near valley center)	Hadley and east/west valley wells	4-24	218-270	500-2,500	200,000-2,300,000
Volcanics (Round Mountain Volcanics)	Pit dewatering wells	Variable	100-500	≥ 500	700-6,500
Volcanics (Dry Creek Volcanics)	Round Mountain townsite wells	4-12.5	387-911	90-120	90-4,800
Basement Rocks (Paleozoic metasediments)	Manhattan wells	48-72	474-913	300-400	10,000-30,000
Geothermal Fault Zone (in southwest project area)	Geothermal wells	48-72	631-769	625-1,000	10,000-24,000
Fault Zone	Test well (immediately west of pit)	34	175-217	17	6,000

Transmissivity values were calculated using various observation wells and calculation methods.
ft - feet
gpm - gallons per minute
gpd/ft - gallons per day per foot
Source: Hydro-Search, Inc. 1994c

Figure 3-1). In the vicinity of the proposed action, the volcanics are subdivided into the Dry Canyon Volcanics and the Round Mountain Volcanics. The Dry Canyon Volcanics are concealed beneath alluvium in the vicinity of the Round Mountain townsite. The Round Mountain Volcanics are exposed in the pit and along the east side of the existing operations.

As shown in ***Figure 3-4***, in the vicinity of the pit, the Round Mountain Volcanics are on the order of 1,000 feet thick. The Round Mountain tuff consists of four distinct zones listed from bottom to top (***Figure 3-4***) (1) basal "lithic tuff," (2) poorly welded "porous tuff," (3) moderately welded "transitional tuff," and (4) the uppermost welded "dense tuff." Because of variation in porosity and fracture characteristics, each of these zones is inferred to possess somewhat different hydraulic characteristics. Ground water flow characteristics for these materials likely range from porous media type flow in the porous tuff to fracture dominated type flow within the welded dense tuff. Transmissivities for the volcanic sequence are generally low, ranging from 90 gallons per day per foot in the Round Mountain townsite wells to 6,500 gallons per day per foot in pit observation wells. Storage characteristics determined from aquifer analyses indicate storativity values between those typically reported for unconfined and confined aquifers (Hydro-Search, Inc. 1994a).

Quaternary Alluvium. Big Smoky Valley represents a fault-bounded basin that has been partially filled with unconsolidated alluvium derived from erosion of the adjacent Toiyabe and Toquima Ranges. The alluvium consists of silt, sand, gravel, and boulders deposited by alluvial fans, intermittent streams, and occasional lakes. These deposits gradually thicken from a thin veneer at the margin of the valley to more than several thousand feet in the valley center. The thickness of these deposits is estimated to be on the order of 3,000 to 5,000 feet along the central and western margins of the valley. Across the project site, alluvium ranges from zero at the eastern edge where

bedrock is exposed to more than 1,000 feet at the western edge (Hydro-Search, Inc. 1994a).

The permeability of these materials varies dramatically from the alluvial fans flanking the mountain fronts to the alluvium in the central portion of the valley. Aquifer testing indicates that transmissivity values for the alluvial fan deposits adjacent to the pit are low to moderate (6,700 to 30,000 gallons per day per foot), whereas the alluvial deposits near the center of the valley have very high transmissivities (200,000 to 2,300,000 gallons per day per foot). Discharge rates for the aquifer tests for the wells in the valley range from 500 to 2,500 gallons per minute.

Drilling has indicated that the depth to water in the alluvium decreases toward the center of the valley. At the project site, ground water in the alluvium is 310 to 425 feet under the north leach offload pile and associated rock dumps west of the pit and approximately 180 feet beneath the S-2 leach offload pile in the western portion of the property. In the north-central portion of the valley, ground water in the alluvium is located within a few feet of the surface, as evidenced by extensive phreatophytes and spring discharge areas.

Fault Zones. Ground water flow pathways are influenced by major faults that offset and displace various rock units and older alluvial deposits. Depending on the physical properties of the rocks involved, faulting may create either barriers or conduits for ground water flow. For example, faulting of softer, less competent rocks typically forms zones of crushed and pulverized rock material that behave as barriers to ground water movement. Faulting of hard, competent rocks often creates conduits along the fault trace resulting in zones of higher ground water flow and storage capacity compared to the unfaulted surrounding rock.

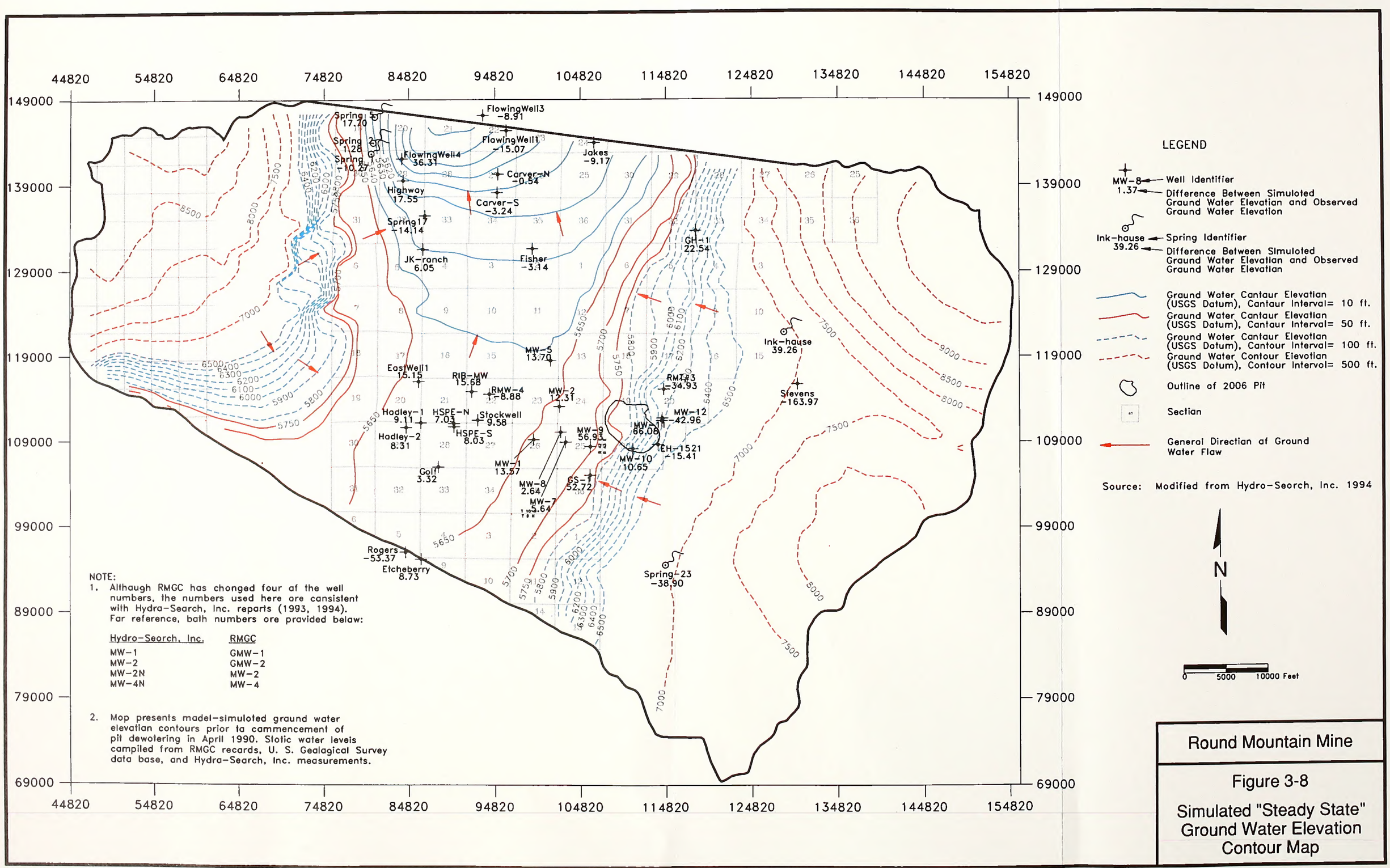
Major faults that may control ground water movement, at least locally, include basin and range type structures, ring faults associated with caldera margins, and other faults located in the vicinity of the pit. The location of these structures is shown on the regional geologic map, ***Figure 3-1***. Major basin and range type normal faults or fault zones are located near both the east and west margin of Big Smoky Valley at the intersection of the mountain fronts. Vertical movement of several thousands of feet is not uncommon along these types of structures. On the site, this style of faulting is manifested as a zone of subparallel north-to-northeast trending range front faults, each of which exhibits hundreds of feet of down-to-the-west displacement. Several other faults or fault zones mapped in the vicinity of the pit include the Stringer/Flourite fault, the Automatic fault zone, and other unnamed northeast and northwest striking structures. Aquifer tests indicate that a fault located directly northwest of the pit and another to the south of the pit had lower transmissivities than the surrounding volcanic rock. In contrast, aquifer tests along the range-front fault indicate that the fault zone has significantly higher permeability than the adjacent, unfaulted volcanic rocks.

A zone of geothermal water exists from an area south of the project site extending north through the site and then northwest across the Big Smoky Valley to Darrough's Hot Spring. In the project vicinity, the geothermal water appears to represent upwelling of geothermal water along the northeast-trending range-front fault. Deep wells along this structure intercept ground water with high temperatures (approximately 180°F) and markedly different chemistry than other bedrock or alluvial ground waters in this area.

Water Levels. A simulated steady state water level contour map is presented in ***Figure 3-8***. For the purposes of this EIS, steady state is assumed to represent the static water level conditions that existed prior to commencement of pit dewatering in April 1990. Static water levels throughout the area were compiled from SVCO records, U.S. Geological Survey databases, well logs, and other measured data (Hydro-Search, Inc. 1994c).

As shown in ***Figure 3-8***, the hydraulic ground water gradients for the upper unconfined system mimic the topography with steep gradients in the mountain ranges and gentle gradients in the valley. Ground water flows toward the axis of the valley and then north. The steep hydraulic gradient in the mountains indicates that the hydraulic conductivity of the bedrock is low. The flat hydraulic gradients in the valley result from the high hydraulic conductivity of the valley alluvium.

Aquifer Recharge and Discharge. The principal source of recharge to the aquifers is precipitation and stream runoff from snowmelt into the valley along ephemeral streams. Where streams emerge from the mountains at the margins of the basin, a high percentage of the stream flow is lost as the



NOTE:

1. Althaugh RMGC has chonged four af the well numbers, the numbers used here are consistent with Hydra-Search, Inc. reparts (1993, 1994). Far reference, bath numbers ore pravided belaw:

Hydro-Seorch, Inc.	RMGC
MW-1	GMW-1
MW-2	GMW-2
MW-2N	MW-2
MW-4N	MW-4

2. Mop presents madel-simuloted ground water elevatian contours prior ta cammencement of pit dewotering in April 1990. Stotic water levels campiled from RMGC recards, U. S. Gealagical Survey data base, and Hydra-Search, Inc. measurements.

LEGEND

- MW-8 / 1.37 — Well Identifier; Difference Between Simuloted Graund Water Elevatian and Observed Graund Water Elevation
- Ink-hause / 39.26 — Spring Identifier; Difference Between Simuloted Graund Water Elevatian and Observed Graund Water Elevation
- Graund Water Cantaur Elevation (USGS Datum), Cantaur Interval= 10 ft.
- Graund Water Cantaur Elevation (USGS Datum), Cantaur Interval= 50 ft.
- Ground Woter Cantaur Elevotian (USGS Datum), Cantour Interval= 100 ft.
- Graund Water Contour Elevotian (USGS Dotum), Contour Intervol= 500 ft.
- Outline of 2006 Pit
- Sectian
- General Directian af Ground Water Flaw

Source: Modified from Hydro-Seorch, Inc. 1994

N

0 5000 10000 Feet

Round Mountain Mine

Figure 3-8

Simulated "Steady State" Ground Water Elevation Contour Map

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water infiltrates and recharges the porous alluvium. The bedrock aquifers receive recharge from infiltration of rainfall and snowmelt to fractures in bedrock outcrops. In addition, the bedrock probably receives some recharge seasonally from the alluvial aquifer. Locally, where the stream channels are incised into bedrock, the bedrock complex is probably also seasonally recharged directly by stream flow. Other sources of recharge include recharge from agricultural irrigation and recharge related to mining activities (injection of spent geothermal water and infiltration at the rapid infiltration basin).

The aquifers discharge in the Big Smoky Valley by several mechanisms, including evapotranspiration, spring discharge, and pumping. The largest discharge is from evapotranspiration by phreatophytes in the north-central portion of the valley. A line of springs along the northwest margin of the valley also represents aquifer discharge. A large volume of ground water is also discharged by pumping the alluvium in the valley for agricultural, industrial, and domestic purposes. Pumping the bedrock aquifer to dewater the mine represents a relatively small volume of aquifer discharge.

Well Inventory. An inventory of water supply wells was conducted as part of this EIS to provide information on wells located within the vicinity of the proposed action. According to the Nevada Division of Water Resources records, a total of 67 water supply wells have a current permit or certificate status; these are the only wells in the study area that have an active water right with the State of Nevada. Other wells may exist in the area, including monitoring wells around the mine, but these do not have an active water right use status. Information on these wells is summarized in ***Table 3-8***; the well locations are shown in ***Figure 3-9***.

Most of the wells range in depths from approximately 50 to 500 feet and are completed in the valley alluvial sediments. The majority of the wells are clustered in an area approximately 4 miles west of the Round Mountain townsite and in the area surrounding Carvers. Section 29 (near Carvers) contains wells too numerous to plot on ***Figure 3-9*** given the scale of the figure. Geothermal waters have been encountered in this area, indicating major faulting or an abnormally high geothermal gradient. The area also has produced several flowing wells.

Ground Water Quality Standards. Standards for protecting ground water used for human consumption have been adopted by the Nevada Bureau of Health Protection Services from federal primary and secondary maximum contaminant levels. Since ground water in the vicinity of the proposed project is used as a drinking water source, federal and state maximum contaminant levels would apply to the protection of area ground waters.

Ground Water Quality. Water quality monitoring during mining operations has provided a continuous record of ground water chemistry at the site since 1986. Although historical data were reviewed, only the most recent and reliable ground water quality data were used to determine existing conditions in the project area. Ground water quality data were available from a 1993 sampling program conducted by Hydro-Search, Inc. (1993). Sampling locations used by Hydro-Search, Inc. in 1993 are located in ***Figure 3-10***, and selected constituent concentrations are presented in ***Table 3-9***.

Four distinct geochemical water types have been identified in the vicinity of the proposed project, including ground water in the (1) Paleozoic metasedimentary rocks, (2) Tertiary volcanic rocks, (3) geothermal system, and (4) alluvial sediments. The different water chemistries between these regimes is best illustrated using a Piper Trilinear Diagram (***Figure 3-11***)[2].

Ground water from the Paleozoic metasediments is characterized as a calcium-magnesium bicarbonate type with a pH of 6.9 standard units and a total dissolved solids of 1470 milligrams per liter. The waters from the Tertiary volcanics are an intermediate type (between calcium sulfate and sodium bicarbonate) and contain roughly equal amounts of calcium, sodium, sulfate, bicarbonate, and chloride, with pH ranging from 8.1 to 8.4 standard units and total dissolved solids ranging from 334 to 416 milligrams per liter. Geothermal ground waters are predominantly sodium bicarbonate-type waters with high levels of fluoride (greater

[2] In a Piper Trilinear Diagram, anion and cation concentrations are represented as percentages on ternary diagrams (the lower triangles), and the points are projected onto the diamond-shaped area. The trilinear diagram permits the cation and anion compositions of many samples to be represented on a single graph in which major groupings or trends in the data can be visually discerned. Figure 3-11 illustrates the major groupings of ground water types in the vicinity of the proposed project instead of individual data points.

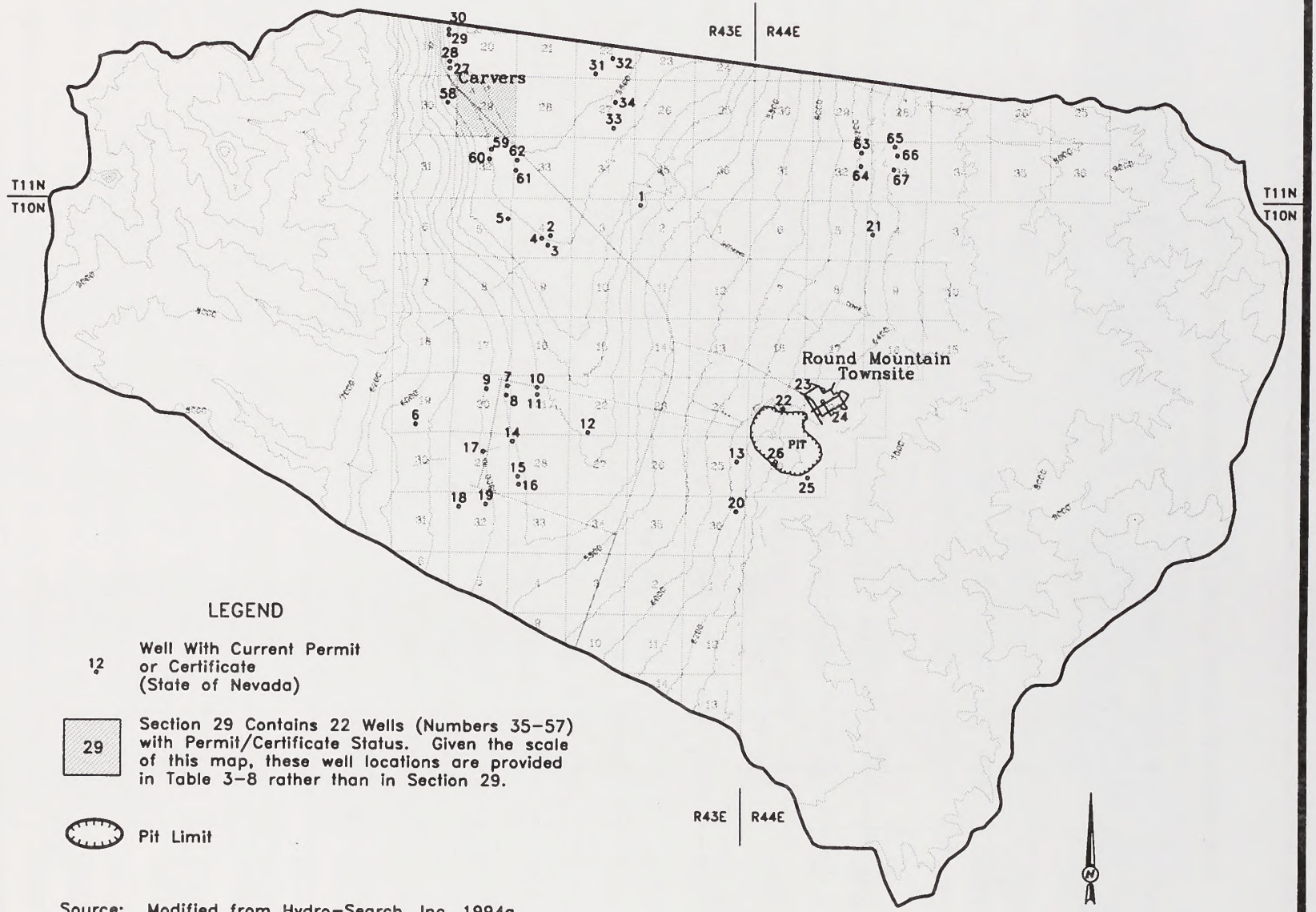
TABLE 3-8
Water Supply Wells with Current Permit or Certificate Status (State of Nevada)

Map Location Number	Application Permit #	Status Permit/ Certificate	Certificate #	Well Location	Use	Owner	Average Station Water Level
1	46219	PER		NW NW 02 10N 43E	IRR	Fisher, Larry D.	
2	52312	PER		NW SE 04 10N 43E	QM	Hoag, Daniel; Hoag, Georjean	
3	52683	PER		NW SE 04 10N 43E	QM	Stevens, Carla	
4	52856	CER	13525	NE SW 04 10N 43E	IRR	Vinson, Frank J.; Vinson, Frank W.; Vinson, Mary M.	
5	38752	PER		NE NE 05 10N 43E	IRR	M&O Partnership; Stevenson, Daniel and Julie	
6	59218	PER		SE SW 19 10N 43E	MM	Smoky Valley Mining Company	
7	26650	CER	13904	NE NE 20 10N 43E	MM	Smoky Valley Mining Company	5660
8	26652	CER	13525	NE NE 20 10N 43E	MM	Smoky Valley Mining Company	
9	52083	PER		NW NE 20 10N 43E	MM	Smoky Valley Mining Division	
10	51577	CER	13186	NE NW 21 10N 43E	MM	Smoky Valley Mining Division	
11	51578	CER	13186	NE NW 21 10N 43E	MM	Smoky Valley Mining Division	
12	12356	CER	3669	SW SW 22 10N 43E	STK	M&O Partnership	5655
13	44299	PER		SE NE 25 10N 43E	MM	Smoky Valley Mining Division	5750
14	50828	PER		NW NW 28 10N 43E	QM	Round Mountain Gold Corporation	
15	54911	PER		SW SW 28 10N 43E	IRR	Round Mountain Gold Corporation	
16	54912	PER		SW SW 28 10N 43E	IRR	Round Mountain Gold Corporation	
17	50426	PER		NW NE 29 10N 43E	QM	Round Mountain Gold Corporation	5723
18	49725	PER		NW NW 32 10N 43E	IRR	Osterhoudt, Wilbur R.	
19	55159	PER		NW NE 32 10N 43E	IRR	Osterhoudt, Jennie M.	
20	50971	PER		NE NE 36 10N 43E	MM	Round Mountain Gold Corporation	5723
21	50426	PER		SW NW 04 10N 44E	MM	Homestake Mining Company of Calif.	
22	44297	PER		NW SW 19 10N 44E	MM	Smoky Valley Mining Division	
23	47570	PER		NE NW 20 10N 44E	QM	Round Mountain Townsite	6243
24	47776	CER	13344	SE NW 20 10N 44E	QM	Round Mountain Townsite	
25	53365	PER		NW SW 29 10N 44E	MM	Smoky Valley Mining Division	
26	59217	PER		SW NE 30 10N 44E	MM	Smoky Valley Mining Company	
27	30966	CER	10369	SE SE 19 11N 43E	COM	Wine Glass Inc.	
28	30967	CER	10370	SE SE 19 11N 43E	IRR	Wine Glass Inc.	
29	52194	CER	13556	NE NE 19 11N 43E	IRR	Wine Glass Inc.	
30	52730	CER	13556	NE NE 19 11N 43E	IRR	Wine Glass Inc.	
31	24757	CER	7835	SE SW 22 11N 43E	STK	Smoky Valley Mining Company	
32	38770	CER	11950	NE SE 22 11N 43E	IRR	Stonier, Carol L.; Stonier, Rea C.	5579
33	30613	CER	13301	SW SE 27 11N 43E	IRR	Carver, Margaret A.; Carver, Richard L.	
34	40619	CER	13304	SW NE 27 11N 43E	IRR	Carver, Margaret A.; Carver, Richard L.	
35	16866	CER	5728	SE NW 29 11N 43E	IRR	Carver, Margaret Weldon; Carver, Richard L.	

TABLE 3-8
Water Supply Wells with Current Permit or Certificate Status (State of Nevada)
(Continued)

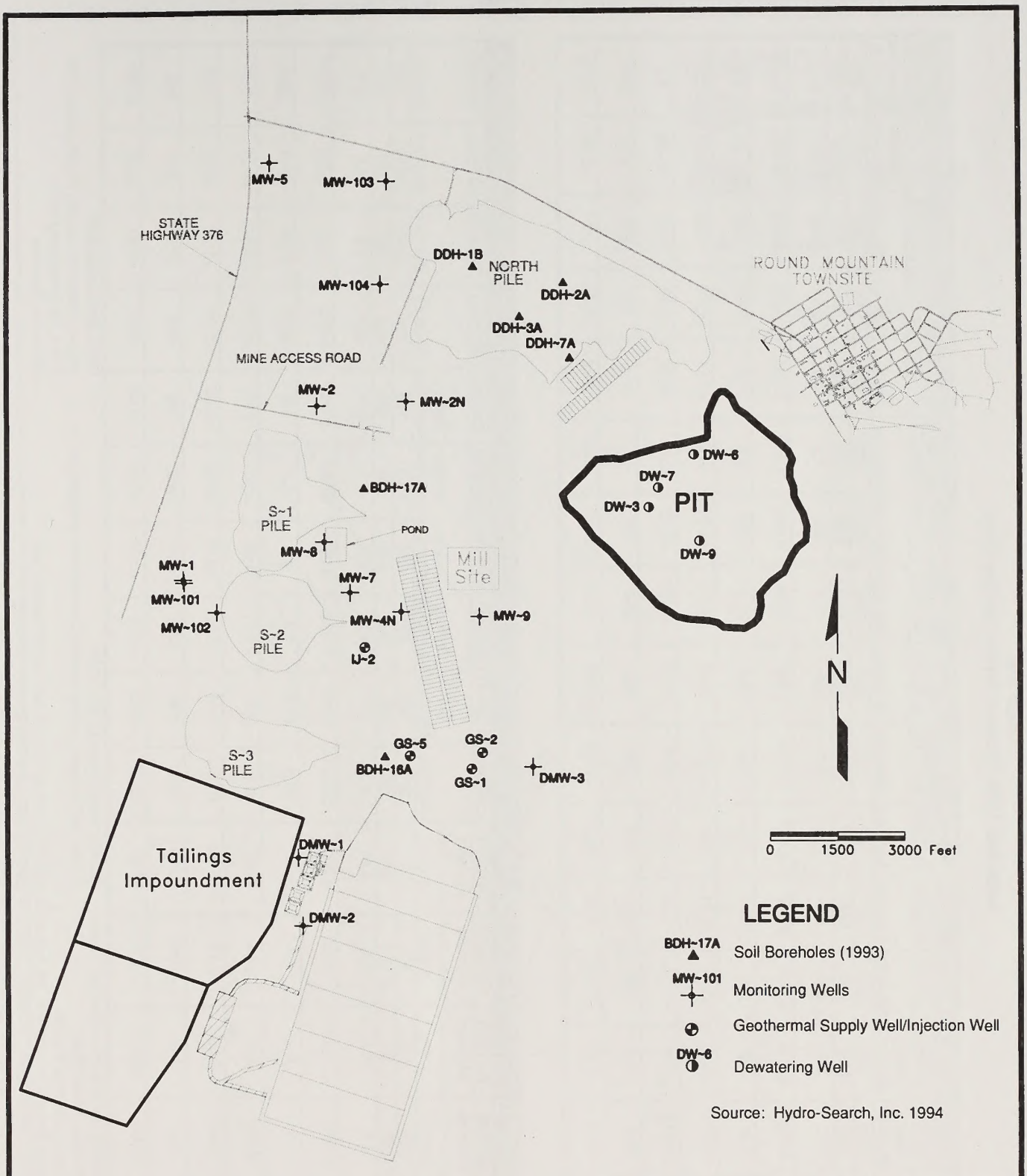
Map Location Number	Application Permit #	Status Permit/ Certificate	Certificate #	Well Location	Use	Owner	Average Station Water Level
36	18840	CER	6767	SE NW 29 11N 43E	IRR	Carver, Margaret Weldon; Carver, Richard L.	
37	20311	CER	5570	NE SW 29 11N 43E	OTH	Highways Department-Nevada	
38	21939	CER	6386	SW NW 29 11N 43E	QM	Getchell, Betty C.; Getchell, Willard E.	
39	25747	CER	8935	SW NE 29 11N 43E	IRR	Chivers, Dorothy R.; Chivers, James A.; Chivers, James D.	
40	26278	CER	9384	SW SE 29 11N 43E	IRR	Williams, Henry E.	
41	29349	CER	9786	NW SE 29 11N 43E	IRR	Chaney, Barbara Jo; Chaney, David L.	
42	29350	CER	6767	NW SE 29 11N 43E	QM	Chaney, Barbara Jo; Chaney, David L.	
43	30834	CER	10002	NW NW 29 11N 43E	DOM	Carver, Gary E.	
44	30897	CER	9768	NW SE 29 11N 43E	QM	Chaney, Barbara Jo; Chaney, David L.	
45	38267	CER	11250	SW NE 29 11N 43E	QM	Jones, Alvin E.	
46	41148	PER		SW NW 29 11N 43E	OTH	Carver, Margaret; Carver, Richard L.	
47	41149	PER		NE NW 29 11N 43E	STK	Carver, Margaret; Carver, Richard L.	
48	41150	CER	13274	SW NW 29 11N 43E	IRR	Carver, Margaret; Carver, Richard L.	
49	41151	CER	13275	SW NW 29 11N 43E	IRR	Carver, Margaret; Carver, Richard L.	
50	41152	CER	13275	SE NW 29 11N 43E	IRR	Carver, Margaret; Carver, Richard L.	
51	43066	CER	13730	SW SE 29 11N 43E	QM	Chaney, Barbara Jo; Chaney, David L.	
52	44670	CER	11430	SW NW 29 11N 43E	QM	Carvers Country; Scott, Gregg; Scott, Sue	
53	44671	CER	11431	SW NW 29 11N 43E	QM	Carvers Country; Scott, Gregg; Scott, Sue	
54	46913	PER		SE SE 29 11N 43E	QM	Berg, Karl W.	
55	48069	PER		NW NW 29 11N 43E	QM	Carver, Bertie W.; Carver, Gary E.	
56	48070	PER		SE NW 29 11N 43E	QM	Carver, Bertie W.; Carver, Gary E.	
57	49809	PER		SE SE 29 11N 43E	QM	Berg, Karl W.	
58	49405	CER	13079	SE NE 30 11N 43E	QM	Nye County Board of Commissioners	
59	46914	PER		NW NE 32 11N 43E	QM	Berg, Karl W.	
60	49810	PER		NW NE 32 11N 43E	QM	Berg, Karl W.	
61	22606	CER	7776	SW NW 33 11N 43E	IRR	Stonier, Carol L.; Stonier, Rea C.	
62	52081	CER	13572	SW NW 33 11N 43E	QM	Stonier, Carol L.; Stonier, Rea C.	
63	50424	PER	Withdrawn	NE NE 32 11N 44E	MM	Homestake Mining Company of Calif.	
64	50425	PER	Withdrawn	SE NE 32 11N 44E	MM	Homestake Mining Company of Calif.	6185
65	50423	PER	Withdrawn	NE NW 33 11N 44E	MM	Homestake Mining Company of Calif.	
66	50421	PER	Withdrawn	NE NW 33 11N 44E	MM	Homestake Mining Company of Calif.	
67	50422	PER	Withdrawn	SE NW 33 11N 44E	MM	Homestake Mining Company of Calif.	

RR = Irrigation
MM = Mining/Milling
QM = Quasi Municipal
COM = Commercial
STK = Stock Watering
OTH = Other
DOM = Domestic


R43E
R44E
T11N
T10N
Carvers
Round Mountain
Townsite
PIT
LEGEND
Well With Current Permit or Certificate (State of Nevada)
Section 29 Contains 22 Wells (Numbers 35-57) with Permit/Certificate Status. Given the scale of this map, these well locations are provided in Table 3-8 rather than in Section 29.
Pit Limit
Source: Modified from Hydro-Search, Inc. 1994a
NOTE:
See Table 3-8 for additional well information.
0 5000 10000 15000 20000 Feet

Round Mountain Mine

Figure 3-9
Well Location Map



Note: Although RMGC has changed four of the well numbers, the numbers used here are consistent with Hydro-Search, Inc. reports (1993, 1994). For reference, both numbers are provided below:

Hydro-Search, Inc.	RMGC
MW-1	GMW-1
MW-2	GMW-2
MW-2N	MW-2
MW-4N	MW-4

Round Mountain Mine

Figure 3-10

1993 Ground Water Sampling Locations

25GM01-D XREF 1993BASE Revision 1-4-96

TABLE 3-9
Selected 1993 Ground Water Quality Data

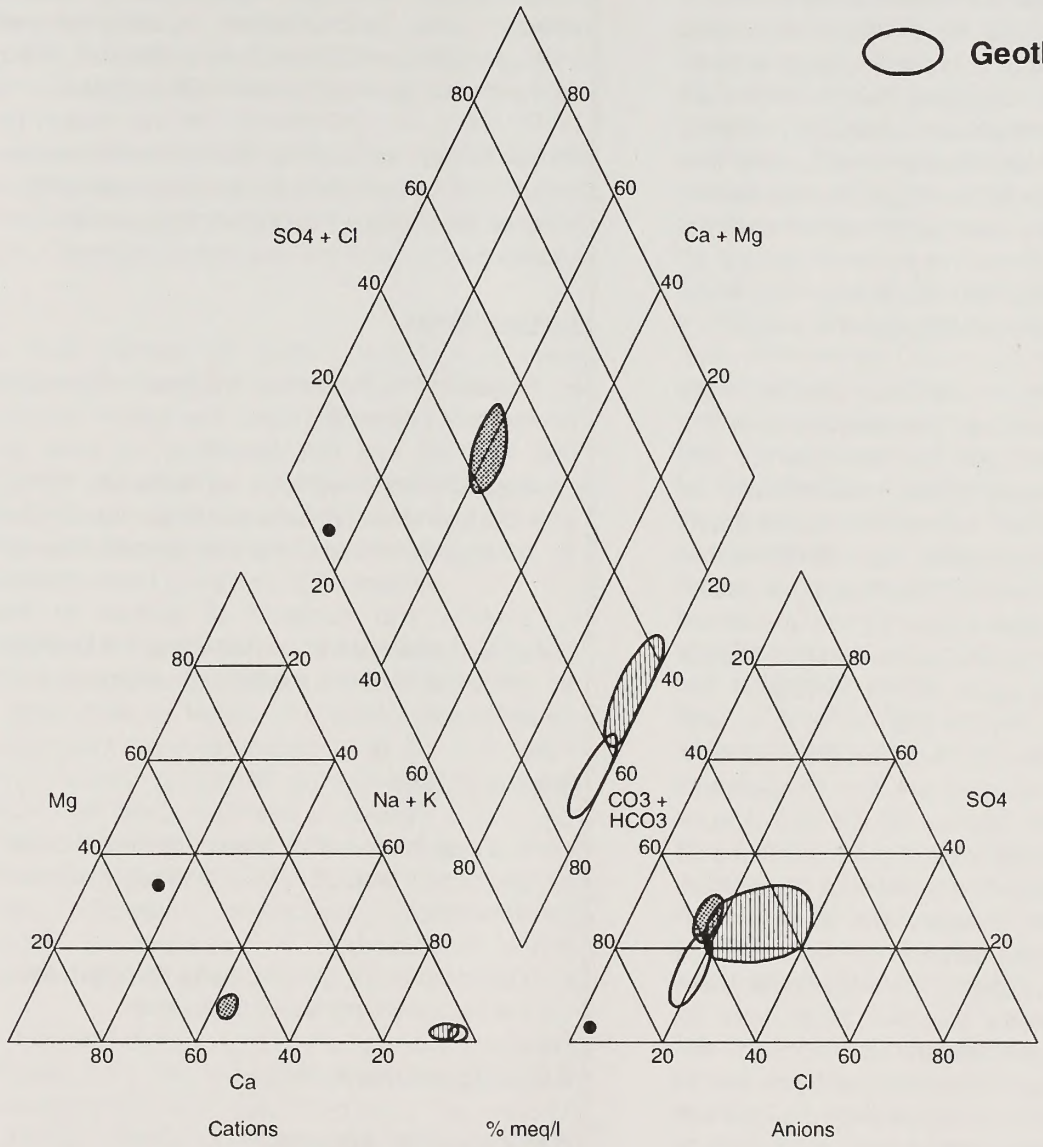
Well ID	MCL	MW-1[4]	MW-2[4]	MW-2N[4]	MW-4N[4]	MW-5	MW-7	MW-8	MW-101	MW-102	MW-103	MW-104	DMW-1	DMW-2	MW-9	DMW-3
Sample Date		04/06/93	04/06/93	03/28/93	04/06/93	04/28/93	04/07/93	05/04/93	05/20/93	05/19/93	05/16/93	05/25/93	04/08/93	04/08/93	05/15/93	04/08/93
Hydrogeologic Regime		Deep alluvium	Deep alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Tertiary volcanics	Paleozoic Bedrock
Total Depth (ft)		1000	1000	340	361	184	335	400	200	219	300	310	310	360	475	630
Well Type		MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
pH (lab) (standard units)	6.5-8.5[1]	8.2	8.2	**8.6**	**8.9**	7.8	**9.1**	**8.9**	**8.7**	**9.0**	7.9	8.2	**8.59**	**8.49**	8.1	6.87
Arsenic (mg/L as As)	0.05[2]	0.028	0.018	0.043	**0.140**	**0.188**	0.049	0.008	**0.060**	**0.050**	**0.046**	0.025	**0.051**	**0.058**	0.025	0.049
Fluoride (mg/L as F)	2.0[1]-4.0[2]	0.81	**2.0**	**9.6**	**20.4**	**18.5**	**21.8**	**20.5**	**21.1**	**19.2**	**6.7**	**7.0**	**21.0**	**18.0**	1.1	**2.2**
Manganese (mg/L as Mn)	0.05[3]-0.1[1]	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.03	<0.03	<0.01	**0.27**
Iron (mg/L as Fe)	0.3[3]-0.6[1]	0.04	0.04	<0.02	<0.02	0.03	0.06	<0.02	<0.02	<0.02	0.27	<0.02	**0.48**	**0.39**	<0.02	**5.2**
Total Dissolved Solids (mg/L)	500[3]-1000[1]	226	212	312	322	240	278	312	294	326	400	214	322	332	334	**1470**
WAD CN (mg/L as CN)	0.2[2]	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.01

Well ID	MCL	DDH-1B	DDH-2A	DDH-3A	DDH-7A	BDH-16A	BDH-17A	DW-3	DW-6	DW-7	DW-9	GS-1	GS-2	GS-5	IJ-2
Sample Date		06/26/93	06/16/93	05/14/93	07/16/93	06/07/93	04/29/93	03/23/93	03/23/93	03/23/93	03/23/93	03/24/93	03/24/93	03/28/93	03/25/93
Hydrogeologic Regime		Alluvium below north dump	Alluvium below north dump	Alluvium below north dump	Alluvium below north dump	Alluvium	Alluvium	Tertiary volcanics	Tertiary volcanics	Tertiary volcanics	Tertiary volcanics	Alluvium	Alluvium	Alluvium	Alluvium
Total Depth (ft)		620	560	655	660	320	320	648	680	602	766	935	1243	1610	1160
Well Type		SB	SB	SB	SB	SB	SB	DW	DW	DW	DW	GS	GS	GS	GS
pH (lab) (standard units)	6.5-8.5[1]	8.0	8.2	7.9	7.6	**9.0**	8.1	8.2	8.2	8.1	8.4	**8.9**	**8.8**	**9.0**	**8.8**
Arsenic (mg/L as As)	0.05[2]	0.003	<0.001	0.002	0.002	0.046	0.006	0.034	**0.090**	**0.053**	0.032	**0.060**	0.030	**0.061**	<0.005
Fluoride (mg/L as F)	2.0[1]-4.0[2]	1.5	0.9	1.9	0.8	**20.0**	**11.0**	1.2	**2.3**	1.2	1.8	**27.5**	**26.2**	**23.0**	**25.8**
Manganese (mg/L as Mn)	0.05[3]-0.1[1]	**0.14**	**0.13**	**0.28**	**0.37**	<0.01	0.01	<0.01	**0.08**	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Iron (mg/L as Fe)	0.3[3]-0.6[1]	0.04	0.03	0.11	<0.02	0.22	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Dissolved Solids (mg/L)	500[3]-1000[1]	196	148	208	192	264	236	416	350	362	398	316	312	314	304
WAD CN (mg/L as CN)	0.2[2]	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

(1) Nevada Secondary Enforceable maximum contaminant level.
(2) Nevada Primary maximum contaminant level.
(3) Federal Secondary maximum contaminant level.
(4) Although RMGC has changed these well numbers, the numbers used here are consistent with Hydro-Search, Inc. Reports (1993, 1994). For reference: MW-1 = GMW-1; MW-2 = GMW-2; MW-2N = MW-2; MW-4N = MW-4.

Source: Hydro-Search, Inc. 1993
Values in bold type exceed applicable maximum contaminant level.

MW = Monitoring Well
GS = Geothermal Supply Well/Injection Well
DW = Pit Dewatering Well
SB = Soil Borehole



Round Mountain Mine

Figure 3-11

Ground Water
Piper Trilinear Diagram

than 20 milligrams per liter), pH ranging from 8.8 to 9.0 standard units, and total dissolved solids ranging from 304 to 316 milligrams per liter (***Table 3-9***, GS-1,2,5, and IJ-2). Ground water in the alluvium is primarily a sodium bicarbonate-sulfate water type with pH ranging from 7.6 to 9.1 standard units and total dissolved solids ranging from 148 to 400 milligrams per liter (***Table 3-9***). The chemical composition of shallow alluvial water samples at the site may be a result of mixing Tertiary volcanic, geothermal, and recharge waters in different proportions. Elevated concentrations of fluoride in samples from shallow alluvial monitoring wells in the southern and western portions of the site suggest an influence from geothermal water. Relatively low total dissolved solids concentrations in samples from the alluvium at the northern end of the site suggest these alluvial waters are influenced by surface water recharge from the east.

With the exception of pH, fluoride, arsenic, iron, and manganese, constituent concentrations in the ground water regimes beneath the site did not exceed federal or state primary, secondary, or secondary enforceable maximum contaminant levels in 1993 (Hydro-Search, Inc. 1993). Water from one upgradient well in the Paleozoic metasediments, DMW-3, also exceeded the maximum contaminant level for total dissolved solids (***Table 3-9***). Deeper ground water in the vicinity of the geothermal well field (***Table 3-9***, GS-1, 2, 5, and J-2) had elevated fluoride and arsenic concentrations as well as elevated pH and temperature values. Samples from shallow alluvial and deeper geothermal waters in this area of the project site all had fluoride concentrations exceeding the federal secondary maximum contaminant level of 2.0 milligrams per liter and ranged as high as 27.5 milligrams per liter (***Table 3-9***). Arsenic concentrations in ground water samples taken from all water types and from around the project site ranged from less than 0.001 milligram per liter to 0.188 milligram per liter, exceeding the primary maximum contaminant level of 0.05 milligram per liter (***Table 3-9***). These data indicate that the observed concentrations of fluoride, arsenic, iron, and manganese in ground water beneath the site are naturally occurring (Hydro-Search, Inc. 1993).

3.2.2 Environmental Consequences

The primary water resource issues include the following: (1) reduction in surface and ground water quantity for current users and water-dependent resources upstream, within, and downstream of the project from pit dewatering; (2) impacts related to water quality of the postmining pit lake; (3) impacts to ground and surface water quality from the construction, operation, and closure of the proposed mill and tailings facility; (4) impacts to ground and surface water quality from operation and closure of the existing spent leach offload piles; and (5) impacts from flooding, erosion, and sedimentation associated with drainage features in the vicinity of the mill, tailings impoundment, and spent leach offload piles.

Environmental impacts to water resources were judged to be significant if the proposed action or selected alternative could potentially result in the following:

Surface Water

- Measurable reduction in flow of perennial streams or springs
- Degradation of surface water quality constituents based on Nevada water quality standards for appropriate or designated beneficial uses
- Erosion and transport of tailings or leach offload pile material, or potential damage to the mill as a result of inadequate drainage control features

Ground Water

- Reduction of static water levels (10 feet or greater) caused by project dewatering activities
- Degradation of ground water quality based on Nevada drinking water standards

3.2.2.1 Proposed Action

Water Quantity Impacts.

Pit Dewatering System. The bottom of the existing pit extends to depths that are below the regional ground water level. Pit dewatering commenced in 1990 and is projected to continue until mine closure in 2008. Dewatering is required to limit the amount of inflow into the pit and to improve pit wall stability. Dewatering is accomplished with a system of in-pit wells designed to maintain water levels below the floor of the pit as

mining progresses. Future dewatering will likely include wells located both inside and outside the pit.

The pit bottom elevation as of June 1993 was approximately 5,590[1] feet. Dewatering to date has lowered the average elevation of the ground water by approximately 500 feet. Because of the variable hydrogeologic conditions in the pit area, the discharge between the wells has fluctuated; average monthly dewatering rates have ranged from approximately 400 to 600 gallons per minute. The most recent reported dewatering rate (June 1994) was approximately 580 gallons per minute. The use, discharge, and disposal of the dewatering water is discussed in Section 2.2.4.1, Description of the Proposed Action and the Alternatives - Open Pit.

The final planned pit bottom elevation at mine closure will be approximately 5,205[1] feet. This additional mining will require lowering the ground water level an additional 300 feet (total of 800 feet). Pit dewatering will continue to decrease ground water levels in and around the pit. Any wells and springs located within the zone of drawdown could potentially be impacted

Numerical Flow Modeling. The general dewatering requirements, projected area of drawdown of the ground water levels, and postclosure pit lake development were estimated using the U.S. Geological Survey numerical ground water program MODFLOW (McDonald and Harbaugh 1988). The modeling was performed by Hydro-Search, Inc., and details regarding the conceptual model, model design, calibration, simulations, and sensitivity analysis are presented in Hydro-Search, Inc.'s technical report (1994c).

The modeled domain and model grid are illustrated in ***Figure 3-12***. The modeled area encompasses a 190-square-mile area extending from the crest of the Toiyabe Range on the west to the crest of the Toquima Range on the east. The southern boundary of the model corresponds to the basin boundary between the Northern Big Smoky Valley Hydrographic Basin and the Southern Big Smoky Valley Hydrographic Basin. The northern boundary of the model is an east-west line that passes through the town of Carvers. The model grid is variable spaced with a finer grid in the area of the pit. The model consists of three layers that extend from approximately 11,000 feet along the mountain crests to 1,000 feet below mean sea level.

The known regional hydrostratigraphic conditions and structural conditions were incorporated into the model, and transmissivity values for the hydrostratigraphic units used in the three model layers were based on aquifer test data. Major faults were simulated in the model as discrete, three-dimensional zones assigned hydraulic parameters that were also based on available aquifer test data. Transmissivity values in the calibrated model are within the range of values determined from aquifer test analyses.

The model was initially calibrated to predewatering water level (steady state) using historic water level data. Time series (transient) calibrations were then performed for 4 periods representing 2, 3, and 4 years of pumping and a 44-day pit well recovery test. Forty water level monitoring points were used for the steady state calibration and 81 were used in the transient calibrations. Dewatering pumping was simulated along with agricultural, municipal, domestic, and geothermal pumping. A sensitivity analysis of model calibration was performed by statistically evaluating 26 additional model runs. The calibrated model was used to assess drawdown through the end of the currently proposed mining activity and postclosure as the pit lake develops.

The withdrawal of water for pit dewatering would reduce ground water levels over an area surrounding the pit. The reduction of water levels would be greatest in the immediate vicinity of the pit and would decrease away from the pit.

The hydrogeologic conditions in the vicinity of the mine are complex. As a result, it is not possible to predict the precise boundaries of the area that could potentially be impacted. However, the results of the model provide a reasonable estimate of the general impacts associated with ground water withdrawal.

For this EIS, the estimated area that could experience a decline in ground water levels of 10 feet or more was selected as the general area of drawdown impacts. Drawdowns of less than 10 feet were not considered in the analysis since these changes would probably be indistinguishable from natural seasonal and annual fluctuations in

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

Round Mountain Mine

Figure 3-12
Numerical Ground Water
Flow Model
Domain and Grid

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the ground water levels. The area that could be affected by drawdown of 10 feet or more was determined by subtracting the model-simulated water levels predicted to result from dewatering from the predewatering (static) water levels. The drawdown data were then contoured to produce a drawdown contour map. The maximum extent of the 10-foot drawdown contour was used to delineate the area of potential drawdown impact. In other words, the area contained within the 10-foot drawdown contour is predicted to experience a decline in ground water levels of 10 feet or more, whereas areas outside this contour are predicted to experience declines of less than 10 feet or no decline at all.

The predicted maximum extent of drawdown from mine dewatering at the end of mining (Year 2008) is presented in ***Figures 3-13*** and ***3-14***. The extent of drawdown is limited to the immediate vicinity of the Round Mountain Mine within a 2.5-mile radius of the center of the pit. The impacts to the ground water table are not predicted to extend outside the western or southern margin of the mine property. To the north, the area of drawdown extends approximately 0.5 mile beyond the Round Mountain townsite. The wells within the Round Mountain townsite are located within the drawdown area as discussed below.

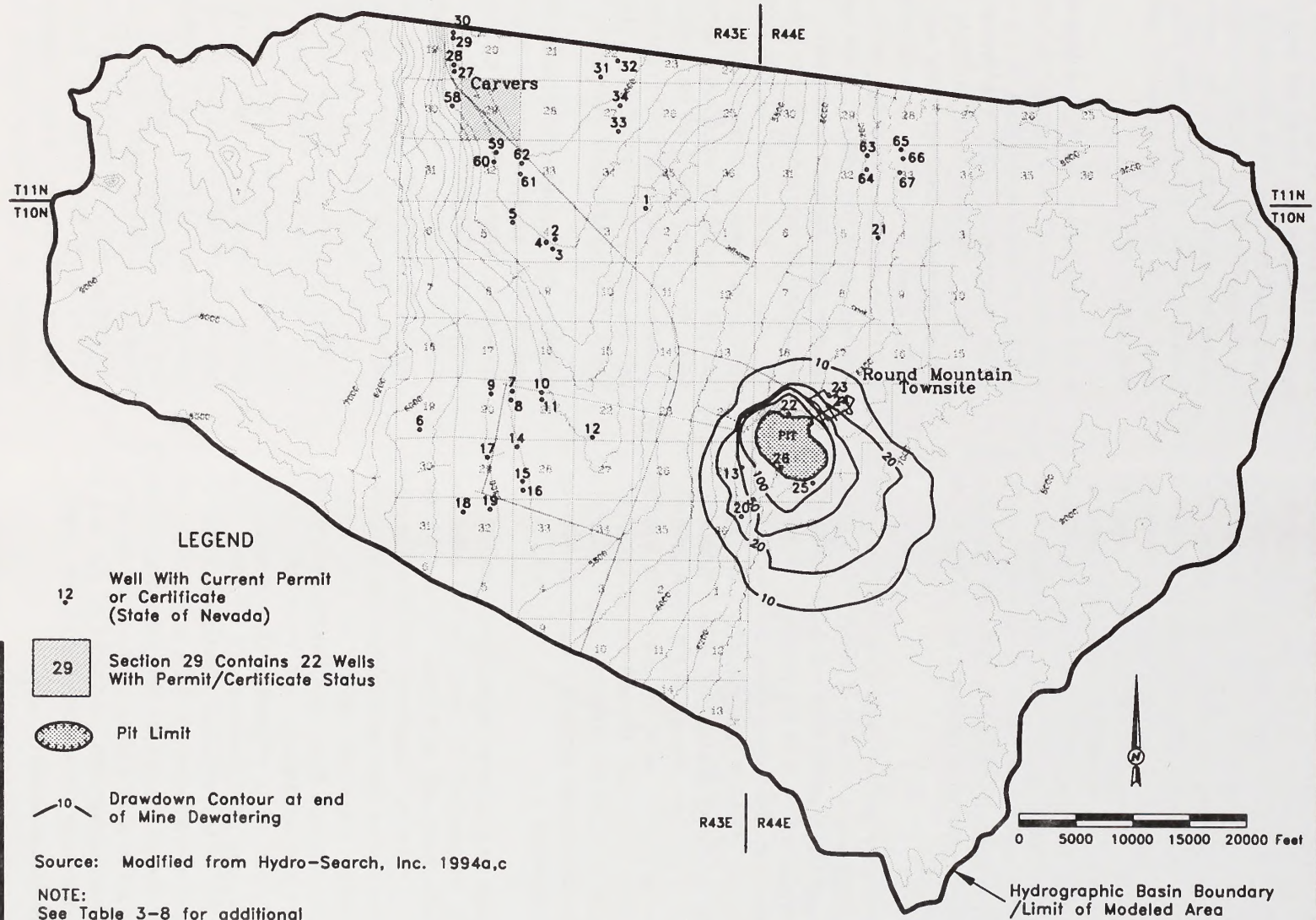
The dewatering cone of depression is predicted to continue to expand for some period after the dewatering wells are shut down and the pit lake begins to develop. Postmining model simulations for different years were evaluated to determine the approximate maximum extent of the 10-foot drawdown contour. The model simulations indicate that the maximum extent of the 10-foot drawdown contour would occur (***Figure 3-15***) approximately 53 years after mining ceases. At 53 years postmining the 10-foot drawdown contour is predicted to extend approximately 3 miles east and 1 mile north of the pit margin. In the postmining period, impacts to the ground water table are not predicted to increase appreciably compared to the end of mining prediction in a western or southern direction from the pit.

Impacts to Wells. State records indicate that two wells (one permitted and one certified) exist within the Round Mountain townsite (***Table 3-8***). The Round Mountain townsite water supply consists of a mixture of ground water withdrawn from one of these wells (Certificate #13344) and spring water captured at Healy and Ink House Springs. As shown in ***Figure 3-13***, ground water model simulations estimate that 10 to 20 feet of drawdown could result from the mine dewatering. Considering the uncertainty of the model prediction, the actual drawdown could potentially be larger or smaller. Excluding wells owned by the SVCO, no other water supply wells are known to exist within the projected impact area.

If the water level in the Round Mountain townsite water supply well were lowered to below the pump settings or below the bottom of the well, the well would become unusable. Information provided by the SVCO (RMGC 1994) indicate that at the Round Mountain townsite water supply well, the water table is located approximately 190 feet above the current pump setting and approximately 500 feet above the bottom of the well. Based on the estimated maximum drawdown of 20 feet, mine dewatering is not anticipated to adversely affect the use of the water supply well. However, considering the close proximity of the well to the pit and the complex hydrogeologic conditions in this area, the water levels in the water supply well located within the Round Mountain townsite should be monitored as described in Section 3.2.4, Monitoring and Mitigation Measures.

Impacts on Springs and Stream Baseflow. As described in the Surface Water Inventory section, the flowing reaches observed in the late summer inventory (August 29 to September 1, 1994) in the vicinity of the proposed project were believed to represent discharge from the ground water system. Impacts to streams and springs were evaluated by overlaying the predicted 10-foot drawdown contour on the surface water inventory map. As shown in ***Figure 3-14***, the predicted drawdown is not anticipated to impact the identified flowing reaches or springs. Healy Spring, the nearest identified perennial spring, is located approximately 3,100 feet northwest of the predicted maximum extent of the 10-foot drawdown contour. The lower flowing reach of Jefferson Canyon is located approximately 2,500 feet north of the predicted 10-foot drawdown contour. Therefore, mine dewatering is not expected to significantly impact surface water resources.

Water Quality Impacts. Proposed or existing activities and facilities evaluated with respect to water quality impacts include (1) the existing leach offload piles; (2) the proposed mill, tailings impoundment, and associated facilities; and (3) the

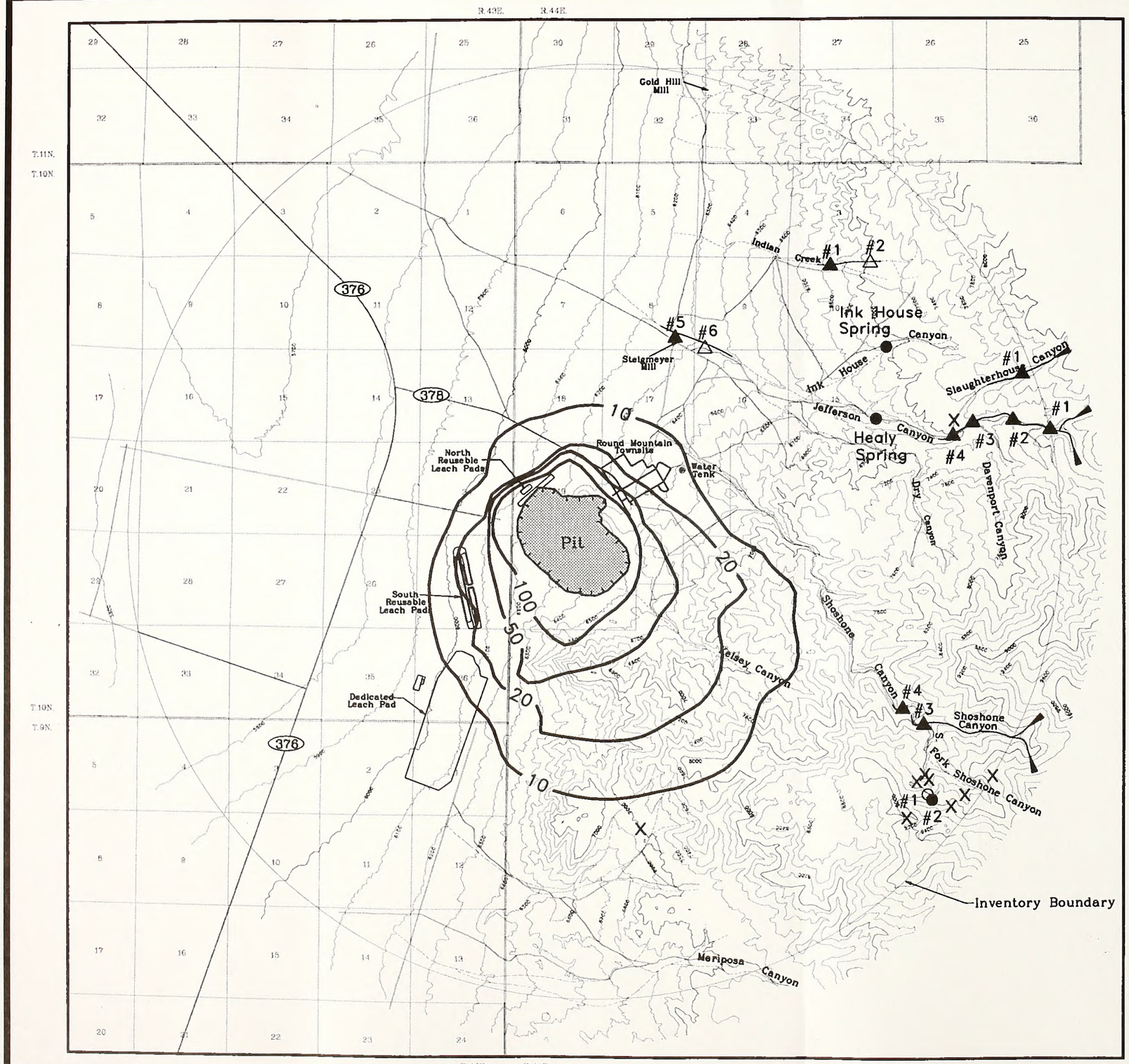


Source: Modified from Hydro-Search, Inc. 1994a,c

NOTE:
See Table 3-8 for additional well information.

Round Mountain Mine

Figure 3-13
Predicted Drawdown at End of Mining and Potentially Impacted Wells



LEGEND

- State Route
- Secondary Paved Roads
- Dirt Roads
- Stream Channel Reaches with No Observed Flow
- Stream Channel Reaches with Observed Flow
- Drawdown Contour
- Indicates Stream Flow Observed From Channels Outside the 5-Mile Radius
- #1 ▲ Stream locations sampled for laboratory analysis
- #2 △ Stream locations where only field parameter and flow data were collected
- #2 ● Inventoried spring or seep that was sampled for laboratory analysis
- #1 ○ Inventoried spring or seep where only field parameter data or no data was collected
- X Dry Spring previously identified by the U. S. Geological Survey
- Land Surface Topography (100-foot intervals Below 7000 feet,msl and 200-foot intervals Above 7000 feet,msl)
- 36 Section Numbers

Source Maps:
U. S. Geological Survey
7.5-minute Topographic Quadrangles:
Pobla Canyon Ranch, NV
Round Mountain, NV
Carvers
Carvers, SE

N

0 0.5 1 Mile

Source: Modified from Hydro-Search, Inc. 1994b,c

Round Mountain Mine

Figure 3-14

Predicted Drawdown and Potentially Impacted Surface Water Resources at End of Mining

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R.43E. R.44E.

T.11N.
T.10N.

T.9N.

Gold Hill Mill

Indian Creek

#1 #2

#5 #6

Steigmeyer Mill

Maximum Extent of Drawdown

376

378

Ink House Spring

Ink House Canyon

#1 Slaughterhouse Canyon

Jefferson Canyon

Healy Spring

#1 #2 #3 #4

Round Mountain Townsite

Water Tank

North Reusable Leach Pads

South Reusable Leach Pads

Dedicated Leach Pad

Pit

200

50

100

20

10

Kelsey Canyon

Shoshone Canyon

#4 #3

Shoshone Canyon

Fork Shoshone Canyon

#1 #2

Dry Canyon

Davenport Canyon

Inventory Boundary

Mariposa Canyon

LEGEND

- 376 — State Route
- Secondary Paved Roads
- Dirt Roads
- Stream Channel Reaches with No Observed Flow
- Stream Channel Reaches with Observed Flow
- Drawdown Contour
- Indicates Stream Flow Observed From Channels Outside the 5-Mile Radius
- #1 ▲ Stream locations sampled for laboratory analysis
- #2 △ Stream locations where only field parameter and flow data were collected
- #2 ● Inventoried spring or seep that was sampled for laboratory analysis
- #1 ○ Inventoried spring or seep where only field parameter data or no data was collected
- X Dry Spring previously identified by the U. S. Geological Survey
- Land Surface Topography (100-foot intervals Below 7000 feet,msl and 200-foot intervals Above 7000 feet,msl)
- 36 Section Numbers

Source Maps:
U. S. Geological Survey
7.5-minute Topographic Quadrangles:
Pablo Canyon Ranch, NV
Round Mountain, NV
Carvers
Carvers, SE

N

0 0.5 1 Mile

Source: Modified from Hydro-Search, Inc. 1995

Round Mountain Mine

Figure 3-15
Predicted Drawdown and Potentially Impacted Water Resources 53 Years After Mining Ceases

3-15.dwg Revision 6-5-95

predicted postmining pit lake. Impacts to water quality were judged to be significant if these facilities or the alternatives could potentially degrade surface water or ground water quality based on applicable Nevada water quality standards.

Leach Offload Piles.

Operation. In 1976, the SVCO initiated the use of the north leach offload pile to store spent ore from the north reusable leach pad; storage of spent ore ceased at the north leach offload pile in 1994. The south reusable leach pad came into operation in 1988; these reusable pads are planned to operate until closure. Spent ore from the south reusable pad is placed on the leach offload piles. All four leach offload piles were designed as unlined facilities.

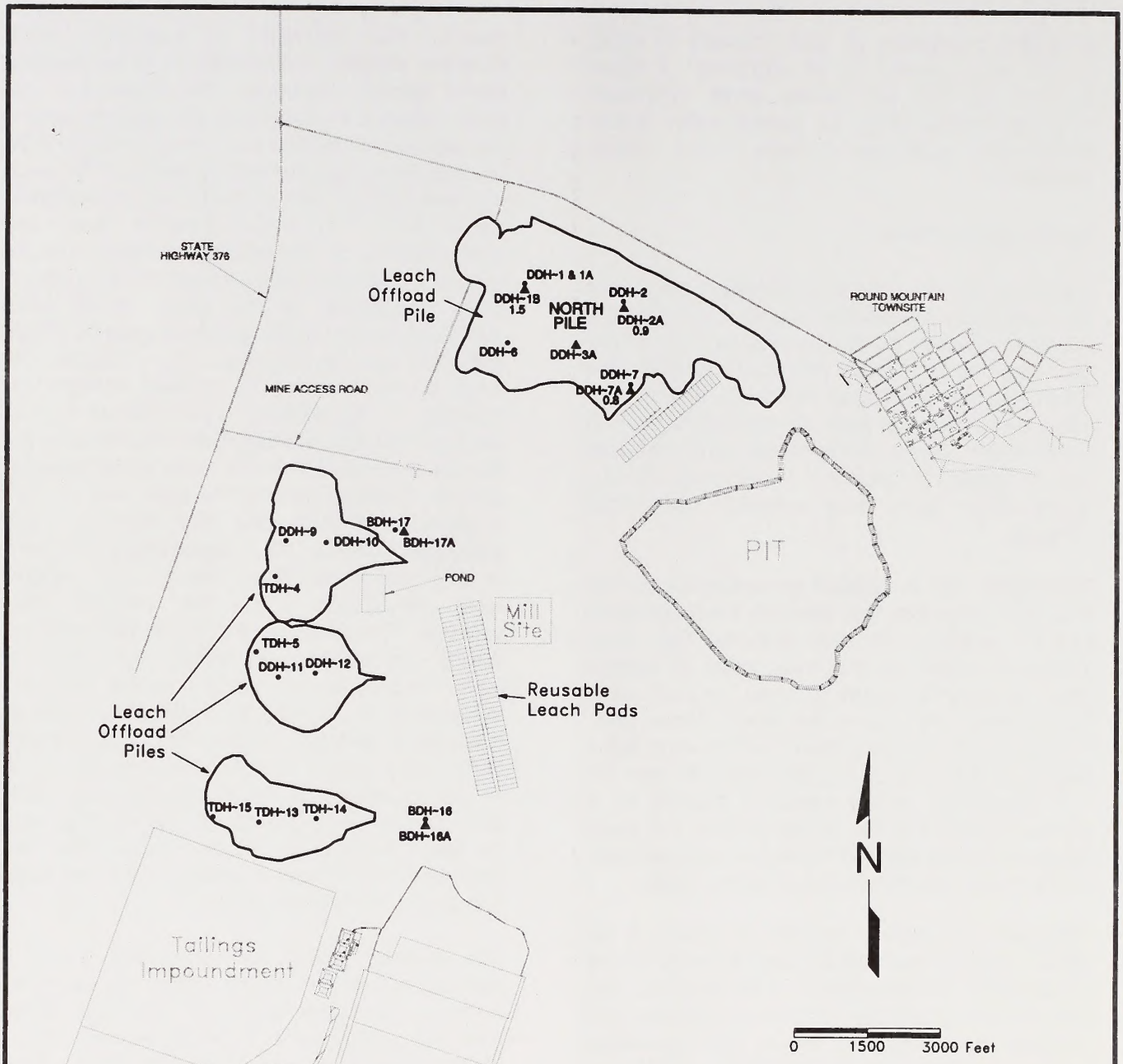
The offload pile material is generated by placing ore on the reusable pad, leaching it with a sodium cyanide solution for approximately 150 days, rinsing the spent ore with fresh water for several days, allowing draindown to occur, and offloading the material onto one of the leach offload piles. The spent ore is end dumped over the edge of the leach offload piles in approximately 80-foot lifts and allowed to aerate before a second lift is placed. During the life of the project, the leach offload piles are planned to receive approximately 323.6 million tons of spent ore (RMGC 1995).

Evaluation of potential impacts to waters of the state from the leach offload piles is based on the geochemical characterization of the materials, the site soil and hydrologic conditions, infiltration and seepage modeling, and native soil attenuation testing. Investigations by WESTEC (1991) and Hydro-Search, Inc. (1993) assessed the geochemical characteristics of the spent ore and native soils; Hydro-Search, Inc. also evaluated the potential for runoff or seepage from the leach offload piles to degrade surface and ground water resources (Hydro-Search, Inc. 1993, ERRATA 1994). The results of these investigations are described below.

Spent ore placed on the leach offload piles is exposed to snowmelt and rainfall (meteoric waters) that could potentially create runoff from the piles or percolate into the piles and local alluvial soils. The potential for these waters to mobilize metals and cyanide was evaluated by subjecting representative samples of the spent ore to the Meteoric Water Mobility Procedure. The locations of the leach offload piles and native soil samples used in the geochemical testing are shown in ***Figure 3-16***. The results of the geochemical testing of the spent ore and offload pile material are presented in ***Table 3-10***. The results indicate that mean concentrations of the leachate derived from the spent ore (leached and rinsed ore in the process of being transported to the leach offload piles) exceeded Nevada drinking water standards for pH, antimony, arsenic, selenium, and cyanide. The mean concentration of the leachate derived from samples of the existing leach offload material exceeded Nevada drinking water standards for pH, arsenic, and iron. The mean weak acid dissociable cyanide concentrations for the spent ore from the reusable pad exceeded the drinking water standards; however, the concentrations of cyanide in all of the leach offload pile material samples were consistently below the drinking water standard. This indicates that while the spent ore initially contains residue cyanide from the heap leach process, the cyanide is unstable and tends to degrade to acceptable levels with continued exposure to sunlight, oxygen, and carbon dioxide in the leach offload piles. In summary, the results of the geochemical tests suggest that some exceedances could potentially occur if water were to seep through the leach offload piles and discharge directly into a protected surface water source or ground water aquifer.

The potential exists for stormwater runoff to mobilize metals and cyanide from the spent ore material. The upper surface of the leach offload piles are graded at a slope of approximately 1 percent toward the east to prevent surface water from ponding on the surface of the piles; therefore, significant impacts to water fowl, wildlife, or livestock from ponded water are not anticipated. Because of the slope design of the offload piles, the majority of the stormwater runoff will flow toward the east (uphill) side of the offload piles and infiltrate at the margin of the offload piles or flow to stormwater sedimentation/infiltration structures. All stormwater runoff would, therefore, be anticipated to evaporate or infiltrate within the project site.

As described above and indicated in ***Table 3-10***, some leachate constituents may be contained in meteoric water runoff from the leach offload piles.



LEGEND

BDH-17A ▲ Soil Boreholes (1993)

BDH-16 ● Soil Boreholes (1991)

Source: Hydro-Search, Inc. 1994

* Revised 6/17/94

Round Mountain Mine

Figure 3-16

Leach Offload Pile and Native Soil Sampling Locations

25GM01-E XREF 1993BSE1 Revision 8-16-95

TABLE 3-10
Mean and Range of Selected Meteoric Water Mobility Procedure Data for Spent Ore and Native Soils

Sample Type	Nevada Drinking Water Standards[1]	Spent Ore - Reusable Leach Pads				South Leach Offload Pile Material				Background Soil				Soil Downgradient of Leach Offload Piles			
		n	Mean	Max	Min	n	Mean	Max	Min	n	Mean	Max	Min	n	Mean	Max	Min
pH (standard units)	6.5-8.5	20	**9.64**	**10.40**	8.20	10	**8.86**	**10.00**	7.84	7	8.39	**9.20**	7.60	6	**8.65**	**9.30**	7.91
Antimony (mg/L as Sb)	0.006	20	**0.011**	**0.029**	0.004	10	- - -[3]	**<0.500**	0.004	5	0.002	0.006	<0.001	6	0.002	0.004	<0.001
Arsenic (mg/L as As)	0.05	20	**1.055**	**1.800**	**0.210**	10	**0.777**	**3.60**	0.039	7	**0.106**	**0.400**	<0.005	6	**0.075**	**0.210**	0.014
Beryllium (mg/L as Be)	0.004	20	**<0.005**	**<0.005**	**<0.005**	10	- - -[3]	**<0.050**	**<0.005**	6	**<0.005**	**<0.005**	**<0.005**	6	**<0.005**	**<0.005**	**<0.005**
Fluoride (mg/L as F)	4	20	1.47	2.00	1.10	10	3.60	**8.90**	1.60	7	3.49	**10.4**	0.73	6	1.47	3.00	<0.10
Iron (mg/L as Fe)	0.6[2]	20	0.10	**0.65**	<0.02	10	**1.71**	**6.20**	0.04	7	**0.70**	**3.30**	<0.02	6	**1.56**	**3.25**	0.45
Manganese (mg/L as Mn)	0.1[2]	20	0.020	0.090	<0.010	10	- - -[3]	**<0.500**	<0.010	5	0.050	0.100	<0.010	6	**0.40**	**0.990**	0.040
Mercury (mg/L as Hg)	0.002	20	0.0006	**0.0070**	<0.0001	10	0.0010	**0.0026**	<0.0002	7	- - -[3]	<0.0010	<0.0002	6	- - -[3]	<0.0010	<0.0010
Nickel (mg/L as Ni)	0.1	20	0.08	**0.23**	<0.02	10	- - -[3]	**<0.50**	<0.02	6	<0.02	<0.02	<0.02	6	<0.02	<0.02	<0.02
Nitrate (mg/L as N)	10	20	3.90	**15.3**	0.26	10	2.30	2.59	2.01	7	4.18	**15.3**	<0.02	6	0.39	0.56	0.31
Selenium (mg/L as Se)	0.05	20	**0.063**	**0.124**	0.011	10	0.003	0.018	<0.001	6	0.001	0.002	<0.001	6	0.001	0.001	<0.001
Sulfate (mg/L as SO_4)	500[2]	20	35.8	62.0	6.0	10	101	190	25.0	7	179	368	36.0	6	215	**504**	18.0
Thallium (mg/L as Tl)	0.002	20	<0.002	<0.002	<0.002	10	- - -[3]	**<2.500**	<0.002	6	<0.002	<0.002	<0.002	6	- - -[3]	<0.004	<0.002
Weak Acid Dissociable Cyanide (mg/L as CN)	0.2	20	**1.80**	**7.10**	<0.02	10	0.01	0.04	<0.01	5	0.02	0.05	<0.02	6	0.02	0.02	<0.02

[1] Nevada primary maximum contaminant levels (unless otherwise noted), established to protect the health of humans from potentially toxic substances in drinking water.
[2] Nevada secondary (enforceable) maximum contaminant levels established to protect aesthetic qualities related to public acceptance of drinking water.
[3] The less than symbol (<) indicates that the concentration was below the detection limit. For constituents with minimum concentrations below the detection limit, the mean was calculated assuming the concentration was equal to the detection limit. For constituents with maximum concentrations below the detection limit but higher than the values listed for minimum concentrations, representative mean concentrations could not be calculated.
Values in bold type exceed the Nevada drinking water standard
n - number of samples tested
mg/L - milligrams per liter
Source: Hydro-Search, Inc. 1993

Where runoff collects in existing or proposed sedimentation/infiltration structures or in other depressions along the side and toe of offload piles, the potential exists for soil and plant contamination.

Uptake of the constituents by wildlife and livestock (postclosure) could potentially result in toxic exposure. However, the potential for this to occur is limited by the low precipitation and high evaporation rates in the area. In addition, alkaline soil chemistry in the project area will largely restrict the mobility of the constituents in question. Studies have shown that little or no migration occurs from contaminated zones into replaced growth media under such conditions (McFarland et al. 1992). Further, soils with pH levels typical of the site generally maintain trace elements in forms that are largely unavailable to plants (Buckman and Brady 1969, Alloway 1990). However, the potential for impacts related to process or geochemical constituents in runoff exists; therefore, mitigation has been identified.

The project site in the vicinity of the leach offload piles is underlain by 180 to 425 feet of unsaturated inhomogeneous alluvium. Water balance modeling showed that water infiltrating the alluvium in the vicinity of the offload piles would require on the order of 360 to 540 years to reach the water table (Hydro-Search, Inc. 1993). In addition, soil attenuation test results indicate that elevated metals

and cyanide would attenuate to below background levels after infiltrating through 20 feet of site soils (Hydro-Search, Inc. 1993). Therefore, any metals and weak acid dissociable cyanide potentially mobilized by snowmelt or rainfall that runs off the piles or seeps through the piles and later infiltrates the alluvial soils would be rapidly attenuated in the upper soil column. These results indicate that significant impacts to surface or ground water quality from the leach offload piles are not anticipated.

The results of these geochemical characterization and hydrologic studies (Hydro-Search, Inc. 1993) were presented to the Nevada Division of Environmental Protection as a supplement to the mine's Water Pollution Control Permit. The study results, which concluded that there is no potential for the leach offload material to contaminate waters of the state, were approved by the Nevada Division of Environmental Protection in January 1995.

Postclosure. Criteria for stabilizing spent ore are found in the Nevada Administrative Codes, Chapter 445, Section 445.24354, and are given below:

(1) The remaining solid material, when representatively sampled, does not contain levels of contaminants that are likely to become mobile and degrade the waters of the state under the conditions that will exist at the site.

(2) The spent ore is stabilized in such a fashion as to inhibit meteoric waters from migrating through the material and transporting contaminants that have the potential to degrade the waters of the state.

The reclamation plan for the Round Mountain Mine (RMGC 1995) describes the planned closure of the leach offload piles. Closure includes regrading and covering the piles with growth medium. It is anticipated that the final leach offload pile surfaces would be composed of suitable-sized material that would limit the erosion potential of the placed growth medium. The resoiled piles would be contour scarified to prepare the seed bed and further reduce the soil erosion potential. When final reclamation has been achieved, the natural evapotranspiration cycle would inhibit the potential for precipitation to leach and transport contaminants from the offload piles. Therefore, no significant impact to waters of the state are anticipated.

Mill and Tailings Facilities Impacts.

Construction and Operation. The mill, tailings impoundment, and associated facilities would be designed for zero discharge to surface and ground water. Currently, the Round Mountain Mine site operates under a zero discharge water pollution control permit from the Nevada Division of Environmental Protection (RMGC 1993b). This permit would be modified for construction and operation of these facilities. The permit establishes zero discharge guidelines of operation for the process components and ancillary activities to protect surface and ground water.

The proposed tailings facility would include a double liner consisting of a 60-mil (0.001-inch) thick high density polyethylene primary liner underlain by 12 inches of soil compacted to a permeability rating of $1x10^{-6}$ centimeters per second that would act as a secondary liner. The design also includes an underdrain system designed to reduce the head on the synthetic liner and allow the tailings to consolidate and drain. Tailings underdrainage would discharge to a collection channel located along the downgradient edge of the facility. The collection channel would convey the solution to the process solution ponds. Both the collection channel and solution ponds would be constructed with a double synthetic liner and intermediate leachate collection and recovery system. The leachate collection and recovery system would consist of a highly pervious layer placed between the two liners designed to capture and convey any solution that leaks out of the primary liner into a gravel filled sump. Periodic monitoring of the sump collection system would allow for leak detection. The secondary liner would function as a seepage barrier in the event the primary liner is damaged. The tailings delivery and reclaim water pipelines would be located in a ditch and lined with compacted soil to control potential spills or leaks. The components of the mill and tailings facilities are designed to minimize the potential for process solution or meteoric water that comes into contact with the tailings to leak out of the facilities. The design features for these facilities comply with current Nevada Division of Environmental Protection regulations.

Technical investigations have been performed to assess the suitability of spent ore material for use as a secondary soil liner with respect to its geochemical (WESTEC 1991 and Hydro-Search, Inc. 1993) and permeability (SHB AGRA 1994b)

properties. The results of these investigations were discussed previously for the leach offload piles. Following review of these technical investigations, the Nevada Division of Environmental Protection authorized the use of the spent ore for on-site construction (Nevada Division of Environmental Protection 1995a). The depth to ground water in the vicinity of the tailings facility ranges from approximately 225 to 300 feet below natural ground surface. Considering the depth to ground water, low infiltration rates, and soil attenuation capacity of the native alluvial soils, it is not anticipated that using the spent ore to construct the facility would impact ground water quality. Refer to the previous discussion of the leach offload piles for a discussion of the potential impacts associated with this material.

The geochemical characteristics of the tailings were evaluated by subjecting a representative sample of each of the two tailings types (e.g., spiral and carbon-in-leach) to the EPA's Toxicity Characteristic Leaching Procedure and the Nevada Division of Environmental Protection's Meteoric Water Mobility Procedure. The EPA's Toxicity Characteristic Leaching Procedure is used to evaluate whether or not a material is classified as hazardous. Characterization of the tailings material using the EPA's Toxicity Characteristic Leaching Procedure indicates that neither tailings type exhibits hazardous properties (***Table 3-11***). The Meteoric Water Mobility Procedure is used to determine if the material has the potential to leach metals and cyanide under meteoric conditions. Geochemical results of Meteoric Water Mobility Procedure tests from spiral tailings samples indicate that the spiral tailings do not exhibit the potential to release substantial concentrations of constituents under meteoric conditions. Results of the Meteoric Water Mobility Procedure for the carbon-in-leach tailings indicate that iron, lead, manganese, total dissolved solids, and sulfate exceed Nevada's drinking water standards. Although the carbon-in-leach tailings exhibit the potential to release metals under meteoric conditions, these tailings would comprise only 5 to 10 percent of the total tailings, and the facility is designed for zero discharge to surface and ground water.

TABLE 3-11
Selected Meteoric Water Mobility Procedure and Toxicity Characteristic Leaching Procedure Data for Spiral and Carbon-in-Leach Tailings

Constituent	Units	Nevada Drinking Water Standards[1]	EPA Criteria for Toxicity Characteristic Leaching[3] Procedure Tests	Spiral Tailings		Carbon-in-Leach Tailings	
				Meteoric Water Mobility Procedure	Toxicity Characteristic Leaching Procedure	Meteoric Water Mobility Procedure	Toxicity Characteristic Leaching Procedure
Arsenic	mg/L as As	0.05	5.0	<0.05	<0.1	<0.05	<0.1
Barium	mg/L as Ba	2	100.0	<0.01	<0.1	0.14	0.03
Cadmium	mg/L as Cd	0.005	1.0	<0.005	<0.01	<0.005	0.5
Chromium	mg/L as Cr	0.1	5.0	<0.01	<0.05	<0.01	0.01
Copper	mg/L as Cu	1.3		<0.01	NA	<0.01	0.01
Cyanide, Weak Acid Dissociable	mg/L as Cn	0.2		<0.02	NA	0.03	0.016
Fluoride	mg/L as F	4		0.9	NA	0.5	0.46
Iron	mg/L as Fe	0.6[2]		<0.03	NA	**6.35**	0.04
Lead	mg/L as Pb	0.015	5.0	<0.05	<0.3	**0.8**	0.3
Manganese	mg/L as Mn	0.1[2]		0.05	NA	**6.65**	11.8
Mercury	mg/L as Hg	0.002	0.2	<0.0003	<0.1	<0.003	<0.05
pH	standard units	6.5-8.5		7.51	NA	7.48	5.98
Selenium	mg/L as Se	0.05	1.0	<0.1	<0.05	NA	NA
Total Dissolved Solids	mg/L	1,000[2]		160	NA	**2040**	6400
Sulfate	mg/L as SO_4	500[2]		74	NA	**1080**	163
Zinc	mg/L as Zn	5		<0.01	NA	0.01	<0.01

[1] Nevada primary maximum contaminant levels (unless otherwise noted), established to protect the health of humans from potentially toxic substances in drinking water.
[2] Nevada secondary (enforceable) maximum contaminant levels established to protect aesthetic qualities related to public acceptance of drinking water.
[3] Waste with concentrations that exceed these criteria when subjected to the Toxicity Characteristic Leaching Procedure are considered to exhibit hazardous properties.
Values in bold text exceed the Nevada drinking water standard
NA = Not Analyzed
Source: RMGC 1995

Sources of potential impacts to water resources from the proposed mill, tailings impoundment, and associated facilities would include unexpected releases of process solution caused by a break in the pipeline or tear in the liner system. Approval of the tailings facility by the Nevada Division of Environmental Protection would require a modification to the existing Water Pollution Control Permit for the Round Mountain Mine. The permit would require a leak detection system for any double-lined pond. The permit would stipulate that all leak detection ports and sumps be checked on a weekly basis. Any fluid within these ports would be pumped back into the pond, and the amount would be recorded. If any process solution were detected, the pond would be drained and repaired. If some process solution were to be released from these facilities, the solution would evaporate or infiltrate the alluvium within the project area. The seepage would need to pass through 225 to 300 feet of alluvium before encountering the water table. Soil attenuation studies discussed previously have demonstrated that the elevated concentration of metals would be attenuated in the upper portion of the soil column. As a result, even with leakage or occasional spills, it is unlikely that the material would significantly degrade ground water quality in the alluvial aquifer. In summary, considering the design of the tailings facility, surface drainage features, depth to ground water, and attenuation properties of the native soils discussed previously, the potential for the proposed mill, tailings impoundment, and associated facilities to significantly impact waters of the state over the life of the operation is considered minimal.

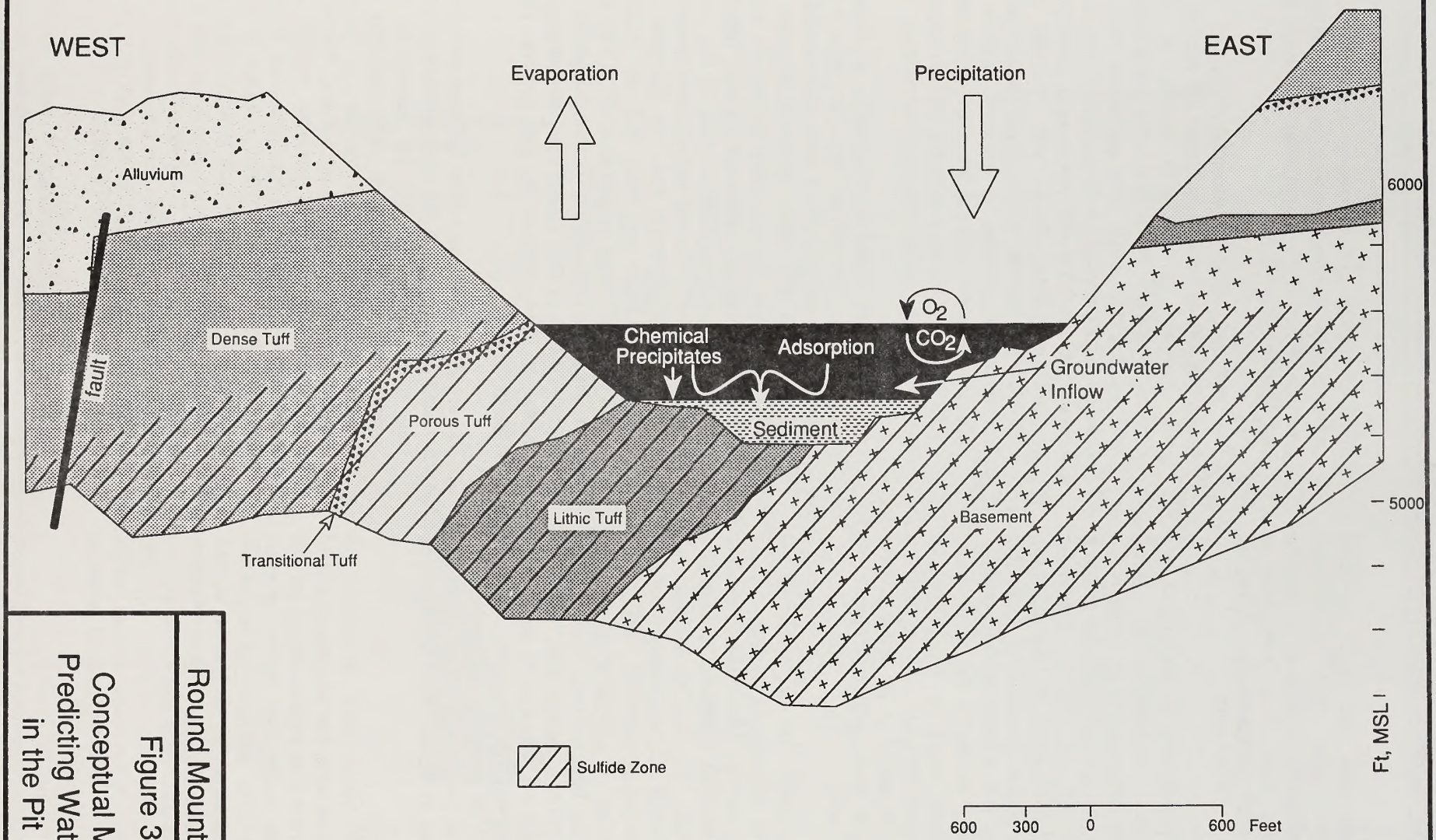
Closure and Reclamation. Criteria for closing a tailings impoundment are found in the Nevada Administrative Code, Chapter 445, Section 445.24356 and are given below:

(1) Representative samples of the material deposited in the impoundment must be collected and characterized.
(2) The tailings must be stabilized during the final closure of a facility so as to inhibit the migration of any contaminant that has the potential to degrade the waters of the state.

In the tailings impoundment, tailings would drain and consolidate, permitting the reuse of process water. An underdrain system and collection pond would be incorporated into the impoundment design to accommodate tailings drainage and to reduce hydraulic head on the synthetic liner, but the majority of reclaimed solution would be decanted from the tailings material surface. Seepage through the underdrain system is expected to decrease during operation because of partial sealing by fine-grained layers within the deposited tailings material. The collection pond is anticipated to be dry before closure. Under the proposed closure plan (RMGC 1995), residual material remaining in the collection ponds would be tested using the Toxicity Characteristic Leaching Procedure and, if necessary, this material would be removed and disposed of in accordance with applicable state and federal regulations before backfilling the pond. In addition, the tailings impoundment would be recontoured to be non-impounding, and the consolidated tailings would be covered with growth media. The pipes associated with the tailing distribution system would be flushed with fresh water for detoxification and sold or disposed of in accordance with applicable state and federal regulations. When final reclamation has been achieved, the naturally high evapotranspiration cycle would inhibit the potential of precipitation to contact and leach constituents from the remaining tailings material and degrade waters of the state.

Seepage through the underdrain system is expected to decrease after spigotting ceases during operation, and the collection pond is anticipated to be dry from evaporation and seepage before closure. If these conditions do not occur and seepage of tailings solution is still occurring through the underdrain system after the cessation of mine processing operations, the seepage would create a potential impact to ground water. Seepage of leaching solution, when compared to state and federal maximum contaminant levels, could potentially contain elevated concentrations of metals, including iron, manganese, and lead. Tailings solution collecting in the pond during closure would need to be handled in a manner consistent with state and federal regulations. In addition, the collection pond could not be closed until all seepage from the underdrain system had ceased. Therefore, mitigation measures have been proposed to minimize potential impacts.

Pit Water Quality. Water quality predictions for the pit lake are based on modeling by PTI (1995). As illustrated in ***Figure 3-17,*** the primary processes controlling the water quality in the pit lake include inflowing ground water composition, sulfide oxidation and acid generation in the pit walls,



Round Mountain Mine

Figure 3-17

Conceptual Model for Predicting Water Quality in the Pit Lake

Source: PTI 1995

leaching of metals from wall rock, chemical reactions in the lake, and evaporative concentration. Postmining conditions in existing mine pit lakes vary widely from metal-bearing, highly acidic conditions to high-quality, pH-neutral conditions.

Ground water flow modeling at the project site indicates that upon completion of mining operations (and the cessation of pit dewatering), the open pit will fill with ground water and create a pit lake (Hydro-Search, Inc. 1994a). The water quality evolution of the created pit lake has been described in a separate geochemical modeling report prepared by PTI Environmental Services, Inc. (PTI 1995). The results of the geochemical modeling have been used to determine the potential for the created pit lake to adversely affect the quality of existing waters of the state, and the ability of the pit lake water quality to support its predicted beneficial uses.

Pit Wall Rock Conditions. The rock units that will be exposed in the ultimate pit surface include Paleozoic metasedimentary basement rocks and Cretaceous intrusive rocks overlain by the Tertiary Round Mountain tuff. This Tertiary volcanic tuff material is differentiated into four types within the pit area; lithic, porous, transitional, and dense (***Figure 3-4***). Although no distinct carbonate unit exists in the pit area, hydrothermal alteration has introduced calcite into all local rock units, which will neutralize most of the acid released by oxidation of pyrite disseminated in the pit walls. A more detailed description of the pit area stratigraphy, including a geologic map and a cross section of the pit, is presented in Section 3.1, Geology and Minerals.

In the conceptual model used to predict the composition of the pit lake, the primary source of acid and metals to the lake is assumed to be wall rock that will oxidize in the time interval between excavation and pit filling. Excavation of the pit will expose sulfide minerals in the ultimate pit surface to atmospheric oxygen, and the resulting oxidation, particularly of pyrite, will form sulfuric acid and will potentially mobilize metals. These oxidation products will remain within pore spaces or be flushed into the pit by inflowing ground water or runoff.

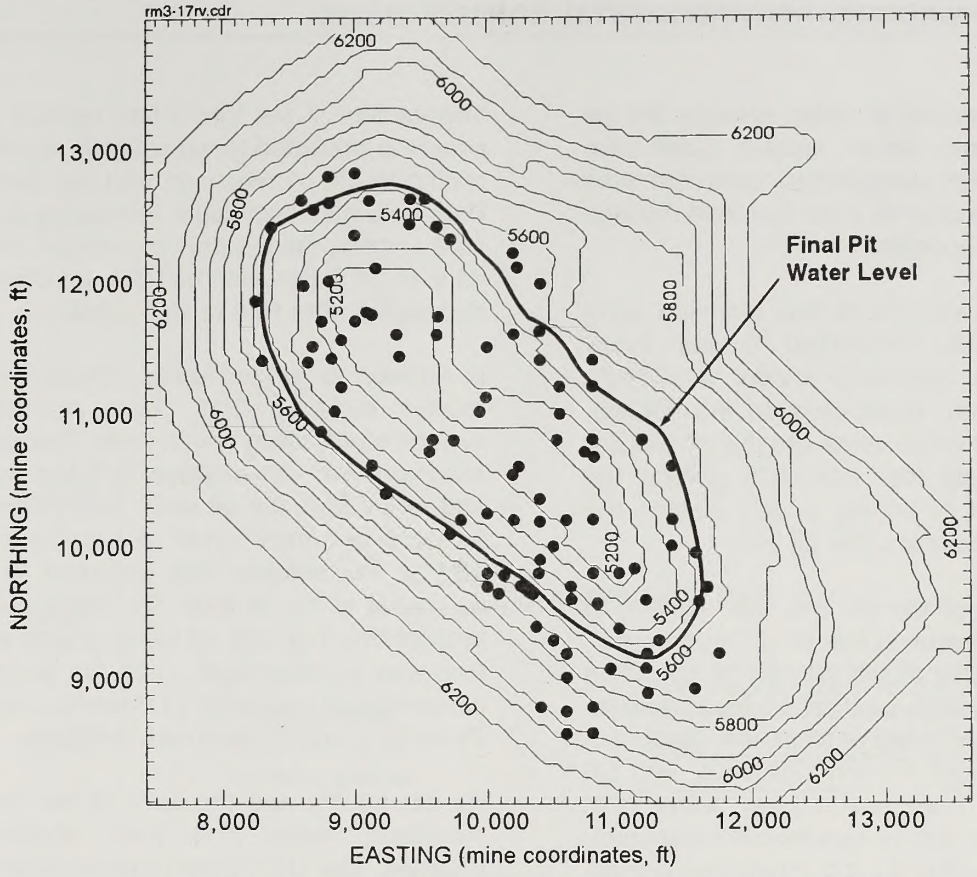
In modeling the potential generation of acid by and release of metals from the pit walls (PTI 1995), 116 samples of the pit wall rock were classified in terms of sulfide sulfur content and carbonate carbon content to determine their net neutralization potential. Pit wall rock sampling locations are illustrated in ***Figure 3-18***.

The net neutralization potential (reported as equivalent tons of calcium carbonate per kilo-ton of rock material [tons $CaCO_3$/kiloton]) is the difference between the sulfide sulfur (mineral that oxidizes to form acid) and carbonate carbon (mineral that neutralizes acid) content of rock, and is used to classify the wall rock as acid generating or acid neutralizing. Rocks with negative net neutralization potential contain excess sulfide, and thus have the potential to generate acid in a reaction with water and oxygen, while rocks with positive net neutralization potential contain excess carbonate and a net potential to consume acid.

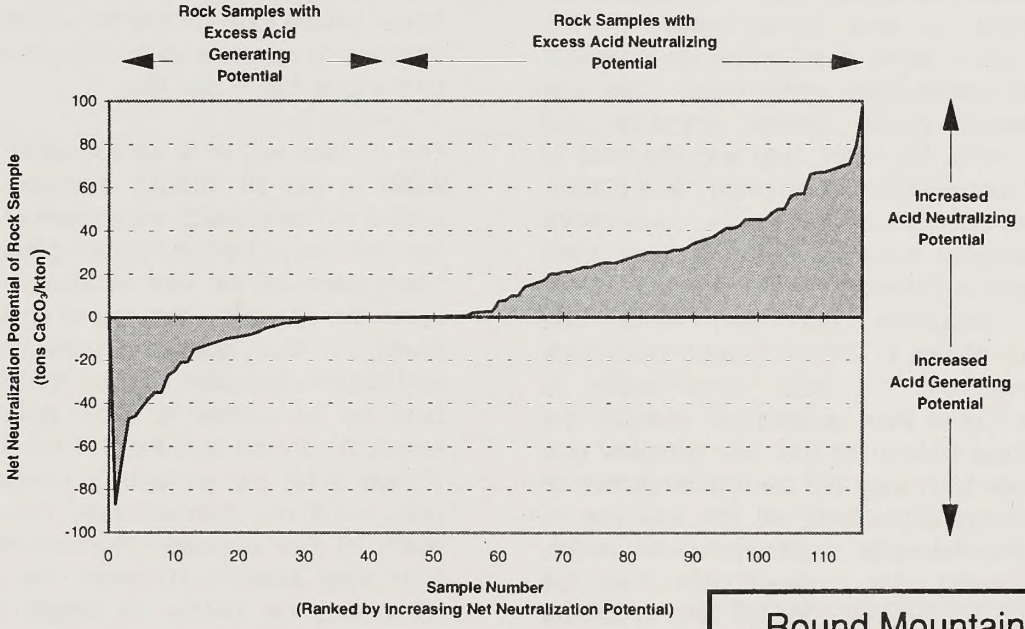
Total sulfide content in the 116 samples of ultimate pit surface wall rock ranged from less than 0.01 percent to 4.0 percent, with a mean concentration of 0.64 percent (PTI 1995). Sufficient amounts of calcite (carbonate carbon) were present in most samples to completely neutralize the acid that will be produced by the sulfide content of the rock. This is expressed in the net neutralization potential values determined from the 116 samples of ultimate pit surface wall rock. The net neutralization potential values ranged from -87 to +97, but the average net neutralization potential value for all samples was +13 (PTI 1995); thus, the frequency distribution was skewed to the positive side (***Figure 3-18***).

The amount of acid and metals released from both net acid generating and net acid neutralizing wall rock was estimated using the results of 20 humidity cell tests. Samples were selected to represent the various rock materials that will be exposed within the ultimate pit surface. The wall rock was assumed to release metals at concentrations equal to those observed in the humidity cell tests. The time that a section of rock was exposed to the atmosphere was calculated as the duration between initial pit excavation and final inundation by the pit lake. The Davis-Ritchie model was then used to calculate the thickness of the oxidized zone that formed in the wall rock as a result of mine excavation (PTI 1995).

Pit Water Balance Conditions. A mass balance approach was used to determine the final pit lake elevation once mining operations cease (Hydro-Search, Inc. 1994c). The water level in the lake will



Locations of 116 Wall-Rock Samples Analyzed for Net Neutralization Potential and Acid Extractable Metals



Net Neutralizing Potential for the 116 SVCO Pit Wall Rock Samples

Source: PTI 1995

Round Mountain Mine

Figure 3-18
Distribution of
Net Neutralization Potential
Wall-Rock Samples and Results

depend on the amount of water entering the pit through ground water inflow, surface runoff from the pit walls, direct precipitation onto the lake surface, and the amount of water lost from the lake surface through evaporation.

Ground water flow into the pit was modeled using MODFLOW, a U.S. Geological Survey three-dimensional, finite difference model (McDonald and Harbaugh 1988, Hydro-Search, Inc. 1994c). Total ground water inflow rates into the pit lake will decrease as the pit fills, from 655 gallons per minute at the end of mining to 321 gallons per minute after full recovery of the pit lake.

The water quality of the pit lake will depend, in part, on the composition of inflowing ground water. Ground water inflows to the pit can be classified into three water types based on source: (1) water from the Paleozoic metasedimentary basement rocks, (2) water from Tertiary volcanics, and (3) geothermal water from fault zones. Water from each source has a distinct geochemical signature, as described in Section 3.2.1.2, Water Resources-Ground Water. Water quality data collected from nine monitoring wells, including one well in the Paleozoic metasedimentary rocks, five wells in the tertiary volcanics, and three wells in the geothermal zone, were used in the geochemical model to represent these water types. Zinc was below detection in the Tertiary volcanics and geothermal wells. However, zinc was detected in the single Paleozoic metasedimentary well (DMW-3). The concentrations of zinc for five consecutive quarterly samples collected between April 1993 and April 1994 in DMW-3 were 9.1, 1.5, 0.52, 0.55, and 0.39 milligrams per liter. Since the concentration of zinc in DMW-3 steadily decreases through time, and the initial concentration is significantly higher than subsequent sample, the average concentration for the five samples (2.4 milligrams per liter) may not be representative of the zinc concentrations that will flow into the pit lake from the Paleozoic metasedimentary rocks. Since the initial zinc concentration may be elevated due to the presence of zinc in drilling materials used during well completion, the pit lake chemistry was predicted both with and without the initially high zinc concentration of 9.1 milligrams per liter (PTI 1995). As a result, two different predicted zinc concentrations are presented in ***Table 3-12***.

The fraction of the total inflow derived from each source is predicted to vary slightly from the end of mining to full pit recovery, with the percentage of Paleozoic metasediments increasing from 38.8 to 45.2 percent, the volcanic component ranging from 44.5 to 47.5 percent, and the geothermal inflow decreasing from 15.0 to 10.3 percent.

In addition to ground water inflows, the lake will receive recharge from direct precipitation and surface runoff along the pit walls. Precipitation was assumed to be an average of 8 inches per year, and runoff from the pit walls was estimated using an average annual runoff of 1 inch per year (HSI 1994c). Precipitation was assumed to contribute no metals to the pit lake. The water quality of the precipitation that runs off the pit slopes and into the lake was approximated using the average solute concentration measured in Meteoric Water Mobility Procedure tests of mine rock materials.

As the pit fills and the area of the lake surface increases, water loss from evaporation will increase. The U.S. Army Corps of Engineers one-dimensional lake model CE-THERM-R1 (a component of CE-QUAL-R1) was used to estimate the net evaporative loss from the pit lake (PTI 1995). Model results indicate that the evaporative loss will increase to approximately 400 gallons per minute by the time the pit lake fills.

The pit lake will fill to an elevation where loss of water in the pit through average annual evaporation will be equal to the amount of water that will flow into the pit from surrounding formations, direct precipitation on the lake surface, and runoff from within the pit walls. Modeling of final ground water levels and flow rates and predicted precipitation and evaporation rates suggest that the pit lake will have no net outflow to either ground or surface waters (Hydro-Search, Inc. 1994c). As illustrated in ***Figure 3-19***, the pit lake is predicted to be 98 percent full after approximately 160 years, and will reach its final elevation approximately 330 years after mine closure. However, the actual rate of filling may be shorter or longer depending on climatic conditions in the post-closure period. After full recovery, the final pit lake elevation is predicted to be 5,528[1] feet, with a surface area of 155 acres and a depth of 323 feet.

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

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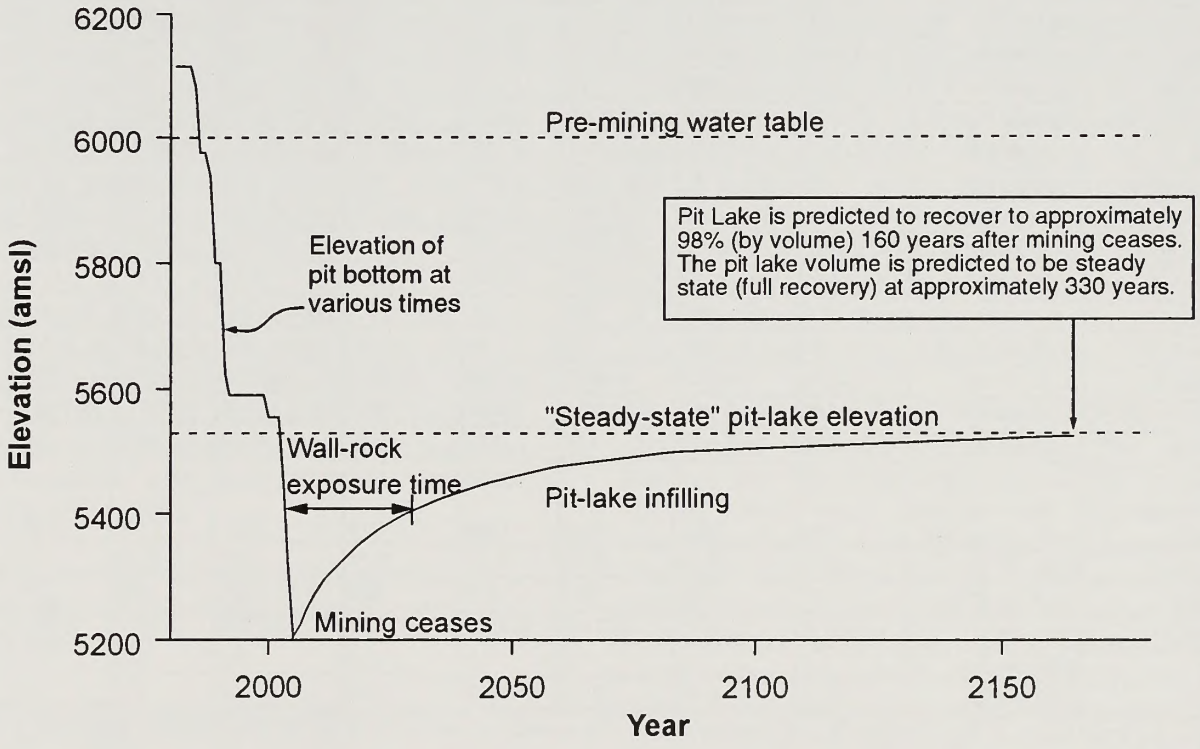


Source: PTI 1995

Round Mountain Mine

Figure 3-19
Pit Lake Recovery and
Wall-Rock Exposure Times

TABLE 3-12
Median Predicted Chemical Concentrations[1,2] in the Pit Lake

	Units	Years After Mine Closure								
		9	22	53	77	159	200	250	300	330
Alkalinity	mg/L as $CaCO_3$	516	589	753	888	1412	1711	2050	2380	2581
Aluminum	mg/L as Al	0.15	0.17	0.21	0.23	0.33	0.38	0.42	0.46	0.49
Antimony	mg/L as Sb	0.0012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L as As	0.0090	0.011	0.013	0.015	0.026	0.033	0.041	0.050	0.054
Cadmium	mg/L as Cd	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	mg/L as Ca	1.9	1.6	1.2	1.0	0.70	0.61	0.55	0.51	0.50
Chloride	mg/L as Cu	39	44	56	67	105	128	155	182	199
Chromium	mg/L as Cu	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L as Cu	0.014	0.014	0.015	0.015	0.017	0.018	0.018	0.019	0.019
Fluoride	mg/L as F	7.8	8.2	10	12	18	22	26	31	33
Iron (III)	mg/L as Fe (III)	0.0011	0.0013	0.0015	0.0017	0.0024	0.0027	0.0030	0.0033	0.0035
Lead	mg/L as Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	0.0013	0.0014
Magnesium	mg/L as Mg	69	77	99	117	194	236	289	340	372
Manganese	mg/L as Mg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mercury	mg/L as Hg	0.00062	0.00060	0.00072	0.00083	0.0013	0.0015	0.0018	0.0020	0.0022
Nickel[3]	mg/L as Ni	0.12	0.086	0.081	0.085	0.10	0.10	0.11	0.12	0.12
pH	s.u.	8.9	9.0	9.0	9.1	9.2	9.3	9.3	9.4	9.4
Potassium	mg/L as K	25	27	34	39	64	78	95	111	121
Selenium	mg/L as Se	0.0034	0.0033	0.0040	0.0046	0.0071	0.0083	0.010	0.012	0.013
Silver	mg/L as Ag	0.017	0.017	0.021	0.024	0.037	0.044	0.053	0.062	0.067
Sodium	mg/L as Na	109	117	147	172	271	329	398	467	510
Total Dissolved Solids	mg/L calculated	764	834	1045	1220	1918	2311	2778	3237	3512
Strontium	mg/L as Sr	0.14	0.10	0.09	0.10	0.11	0.11	0.11	0.11	0.11
Sulfate	mg/L as SO_4	200	206	253	290	452	534	648	764	830
Thallium	mg/L as Tl	0.0015	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016
Zinc[4]	mg/L as Zn	1.1	1.2	1.6	1.9	3.2	4.0	4.9	5.8	6.3
Zinc[5]	mg/L as Zn	0.27	0.31	0.41	0.49	0.84	1.0	1.3	1.5	1.7

[1] Each concentration is the median of 1,000 realizations. Reported concentrations do not necessarily represent a single water chemistry.
[2] Where the concentrations of an individual constituent were below detection, a value equal to half the detection limit was used in the model to estimate concentrations.
[3] Nickel was not detected in any rock or water sample.
[4] Calculated using all data (5 samples) for well DMW-3.
[5] Calculated excluding possible anomalous zinc concentration reported for well DMW-3 on 4/8/93.
Source: PTI 1995

Pit Lake Dissolved Oxygen Concentrations. The thermal stratification and overturn in the pit lake was predicted using CE-THERM-R1. The model predicts that the lake will be monomictic, mixing completely during fall turnover (PTI 1995). In addition to mixing of the water column, the oxygen concentration in the pit lake will be controlled by the biological and chemical demands in the lake. The results of biological oxygen demand calculations indicate that the pit lake will be oligotrophic (i.e., of low productivity) and completely oxygenated during both lake filling and hydraulic steady state (PTI 1995). The results of chemical oxygen demand calculations indicate that the chemical oxygen is relatively small and will not result in anoxic conditions in the water column (PTI 1995). In summary, based on evaluations of the thermal stratification, biological oxygen demand, and chemical oxygen demand, the pit lake is predicted to be completely oxygenated throughout the year. This determination is important in predicting lake water quality, as discussed below.

Pit Lake Water Quality Modeling. Water quality in the Round Mountain pit lake was approximated using a series of quantitative models designed to

simulate the natural processes identified above. Chemical loading from wall rock, ground water inflow, and surface runoff were combined in a given lake volume depending on the estimated fill level of the lake. Solution speciation, precipitation, and adsorption in the pit lake were then calculated to determine the final pit lake composition by applying the EPA's equilibrium geochemical model, MINTEQA2. The modeling approach is based on a series of input parameters and assumptions. Some of the parameters used represent best estimates based on the available information, while other parameters were selected to be environmentally conservative (e.g., iron hydroxide was assumed to be the only available substrate for metals sorption). Therefore, the predicted median water quality results are considered to represent conservative estimates of concentrations in the pit lake. The following assumptions were incorporated into the pit lake water quality model.

- Once wall rock is submerged in the lake, oxidation of sulfide material stops, and all leachate generated by the oxidation is flushed into the lake. This assumption is consistent with previous studies showing that following submergence, wall rock oxidation effectively ceases (PTI 1995).

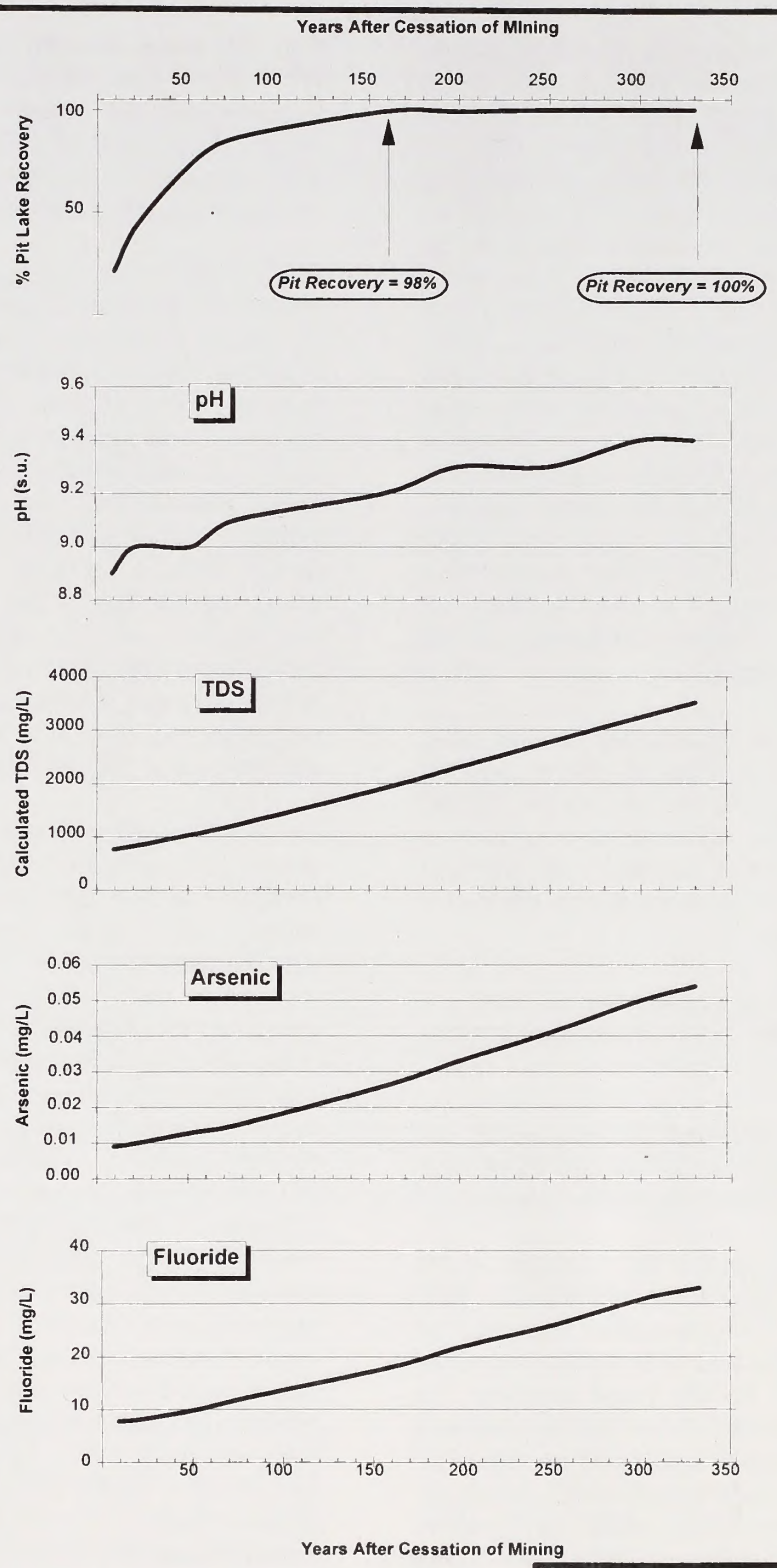
- The entire pit lake is oxygenated (see the discussion of Pit Lake Dissolved Oxygen Concentrations)

- Precipitated or adsorbed chemicals are removed completely from the pit lake by settling and burial in geochemically stable sediment.

MINTEQA2 modeling results for 9 stages of pit lake filling corresponding to 9, 22, 53, 77, 159, 200, 250, 300, and 330 years after mine closure are presented in ***Table 3-12*** (PTI 1995). The water quality was modeled to 330 years following the cessation of mining when the pit lake is predicted to reach hydraulic steady state. It is important to note that because of uncertainties of future climatic conditions, ground water flow rates, and ground water chemistry, the confidence in the predictions of pit lake water quality decreases with increasing time after the end of mining. Therefore, predictions made several decades or centuries in the future should be viewed as indicators of relative trends in concentrations, rather than absolute values. Because the pit lake water chemistry is predicted to vary significantly over time, discussion of the pit lake water quality is subdivided into two periods, 0 to 159 years and 160 years and longer. Within the 0-to-159-year period, the pit lake will fill to approximately 98 percent of the final predicted steady state volume (***Figure 3-20***). After 160 years, the final volume will slowly be reached, and the water levels will stabilize.

Pit Lake Water Quality - 0 to 159 Years . Model results indicate that the water quality of the pit lake in the 0-to-159-year period will be strongly influenced by the addition of chemical constituents from the pit wall rock. The pit is predicted to become more alkaline as it fills because of the continual evaporative concentration of carbonate. The model indicates that the lake pH will steadily increase from 8.9 to 9.2 over the 159-year model period. Thus, it is highly unlikely that the pit lake will be acidic. The model also demonstrates that the majority of the metals/elements (arsenic, cadmium, copper, mercury, nickel, lead, and zinc) will be removed from the pit lake by precipitation of ferrihydrite, which acts to remove the metals by adsorption and settling (***Figure 3-17***).

The water quality of the pit lake is predicted to vary during the 0-to-159-year period. The model predicts that the total dissolved solids, fluoride, sulfate, and most metals will increase in concentration over time. Changes in concentration over time are illustrated for selected chemical constituents in ***Figure 3-20***. Total dissolved solids in the lake are predicted to increase from an initial concentration of approximately 750 milligrams per liter to 1,900 milligrams per liter at year 159. Zinc concentrations are predicted to be 1.1 milligrams per liter at year 9 and increase to approximately 3.2 milligrams per liter at year 159. However, when the apparently anomalous zinc concentration reported for an initial sample from well DMW-3 is removed from the data set, the predicted zinc concentrations increase from 0.27 milligram per liter at year 9 to 0.84 milligram per liter at the end of this period. Arsenic concentrations are predicted to be relatively low, ranging from 0.009 milligrams per liter at 9 years after mining and increase to approximately 0.26 milligrams per liter at 159 years. Nevada primary and secondary enforceable maximum contaminant levels for drinking water will be exceeded for several elements (aluminum, fluoride, magnesium, nickel, sulfate, zinc and total dissolved solids). However, since modeling indicates that the pit lake will not discharge to the surface or ground waters, development of a surface water body in the pit is not expected to degrade surrounding waters of the state,



Round Mountain Mine

Figure 3-20

Predicted Concentration Trends for Selected Constituents During Pit Lake Recovery

regardless of the water quality of the pit lake. As the pit lake develops, the lake water itself will become a water of the State of Nevada. Water quality standards applicable to the lake under the current Nevada Administrative Code would depend on the potential beneficial uses of the lake.

At closure, a 10-foot security fence and a 5- to 8-foot high rocky berm will be constructed around the perimeter of the pit to restrict access into the pit by humans and livestock. In addition, as part of final closure, the ramp leading down into the pit will be blasted (after completion of the pit lake water quality monitoring required by the Nevada Division of Environmental Protection) to further preclude access to the lake. The lake is not intended or anticipated to be a drinking water source for humans or livestock, or to be used for recreational swimming. Therefore, standards to protect the lake as a drinking water source, livestock water supply, or for recreational swimming are not applicable. Aquatic standards are also not applicable since the measures taken to preclude access should prohibit the lake for use as a fisheries resource. The only anticipated beneficial use of the lake water is as a water source for waterfowl and small mammals. A risk assessment of potential pit water quality impacts to birds and terrestrial wildlife has been performed (PTI 1995a), and the details of the risk assessment and potential impacts to wildlife are presented in Section 3.5, Wildlife and Fisheries Resources.

Pit Lake Water Quality - 160 to 330 Years. The water quality was modeled to 330 years after the cessation of mining when the pit lake is predicted to reach hydraulic steady state. As stated previously, because of uncertainties of future climatic conditions, ground water flow rates, and ground water chemistry, the confidence in the predictions of pit lake water quality decreases with increasing time. Therefore, predictions made for this period are presented to evaluate relative trends in concentrations, rather than absolute concentration values.

Predictions of the pit lake water quality indicate that as the pit lake level begins to stabilize, the future pit lake water chemistry will be controlled primarily by evaporative concentration processes. The predicted changes in chemistry for selected constituents are illustrated in ***Figure 3-20***. The model results indicate that pH will continue to increase into the foreseeable future because of the continual evaporative concentration of carbonate from the ground waters (***Figure 3-20***). Thus, the pit lake is not predicted to be acidic. Total dissolved solid concentrations in the water will continue to increase and are predicted to have a concentration on the order of to 3,500 milligrams per liter at the end of the period. Zinc concentrations are also predicted to increase during this period from 3.2 to 6.3 milligrams per liter. As presented in ***Table 3-12***, when the anomalous sample (discussed above) is removed from the data set, the zinc concentrations are predicted to be much lower, increasing over the period from 0.84 to 1.7 milligrams per liter. The concentrations of arsenic are predicted to increase over time with concentrations ranging from 0.026 to 0.054 milligram per liter. Because of the predicted continual inflow of geothermal water that is naturally high in fluoride and the effects of evaporative concentrations, fluoride concentrations are predicted to increase over time to approximately 33 milligrams per liter at the end of the period.

Based on these long-term predictions of the pit lake water quality, the Nevada primary and secondary enforceable maximum contaminant levels for drinking water will be potentially exceeded for several elements (aluminum, arsenic, fluoride, magnesium, nickel, zinc, and total dissolved solids). However, since modeling indicates that the pit lake will not discharge to the surface or ground waters, development of a surface water body in the pit is not expected to degrade surrounding waters of the state.

Although mass balance calculations and modeling were performed out to 330 years after the cessation of mining (predicted time for the water level to reach equilibrium), it is not anticipated that the pit water chemistry will be at chemical equilibrium at this time. The predicted zero outflow scenario means that for the long term the concentrations of most constituents would continue to increase.

Water quality standards applicable to the pit lake itself will depend on its long-term anticipated uses. It is anticipated that uses of the pit lake water for the 160-to-330-year period will be the same as those predicted for the 0-to-159-year period uses. The pit lake water is not expected to be used as a drinking water source for humans or livestock, and no fishery resource is anticipated. Therefore, maximum contaminant levels and surface water quality standards established to protect these uses

will not be applicable to the pit lake. However, access to the pit lake will still be possible for certain birds and terrestrial wildlife, and these potential uses of the pit lake will remain for the long term. Potential impacts to birds and terrestrial wildlife from interactions with the pit lake are described in Section 3.5, Wildlife and Fisheries Resources.

Erosion and Sedimentation Impacts. The construction of the proposed tailings impoundment would locally alter small ephemeral drainages. Small increases in erosion and sedimentation may occur in this area as a result of construction and the concentration of flows at diversion outlets. The extent of such effects would be minor and would be rapidly dispersed over the fan surface. There are no natural surface water bodies in the area that would be affected by sedimentation.

Surface water runoff from the upgradient watershed (approximately 7.4 square miles) would be routed around the leach offload piles, process ponds, and mill and tailings facilities through runoff and sediment control berms or diversion channels implemented as part of the stormwater drainage control plan. The dedicated heap leach pads would offer protection from runon. Precipitation falling directly on the proposed process ponds and tailings impoundment would be contained by adequate freeboard on the impoundments. Long-term pooling on the tailings impoundment surface would be minimized by designing for closure, recontouring, and revegetation to meet postmining objectives, and by high evaporative losses. The leach offload piles would be reclaimed with a stable configuration, revegetated, and protected from runon by the closure topography and drainage features.

Culverts would be constructed as necessary at drainage crossings and disturbed areas would be revegetated as soon as practical according to the proposed reclamation plan. Proposed process components and drainage controls would be designed to withstand runoff from a reasonable storm event (such as a 100-year, 24-hour event). Adequate design and maintenance of runoff controls is part of the proposed action. Both the mill and tailings disposal area are designed to be zero discharge facilities, so no contaminants would be released to surface waters.

Impacts to surface water resources from the proposed action are expected to be minimal as a result of the design, drainage control, and reclamation measures included in the proposed project.

3.2.2.2 Range Management Alternative

The types and extent of potential impacts to surface waters would be the same for this alternative as those described for the proposed action.

3.2.2.3 Tailings Impoundment Alternative

It is assumed in the analysis of this alternative that similar drainage control and closure activities described for the proposed action would be implemented for this site. The types of potential impacts to surface waters would be the same for this alternative as for the proposed action.

This alternative is located at the head of the fan developed as Shoshone Canyon exits the mountain front. A site inspection and review of aerial photographs indicate that the Shoshone Canyon channel may migrate between the northern edge of the Round Mountain townsite and its present position. The upgradient watershed is approximately 10.7 square miles in extent, and is characterized by steep relief reaching elevations of over 9,600 feet. In addition, estimated flood volumes and peak discharges are significantly larger for this alternative than for the proposed action. Therefore, a higher potential for channel instability and flooding may be implied for the alternative site than for the proposed site. Associated surface drainage controls would need to be larger and would require more maintenance than the proposed action.

Natural shifting of the channel position over the long-term postmining period could potentially jeopardize the integrity of stormwater diversions and possibly the impoundment itself. The engineering design would address stabilization of the area. Without stabilizing features, there would be a risk of failure of either component, which would present major adverse impacts to surface water resources by capturing Shoshone Canyon flows, or more likely by releasing process materials and increased sediment loads into the drainage. The potential for migration of process substances into

Jefferson Canyon and downgradient areas would then exist because of the porosity of alluvial fills and the proximity of the alternative site to Jefferson Creek. Such an occurrence would create adverse impacts to downgradient channel stability and water quality.

3.2.2.4 No Action Alternative

Under the no action alternative, the potential impacts associated with closing the tailings impoundment and associated collection pond and underdrain system would not occur. However, the identified impacts associated with mine dewatering and ground water drawdown would be the same for either the proposed action or the no action alternative.

3.2.3 Cumulative Impacts

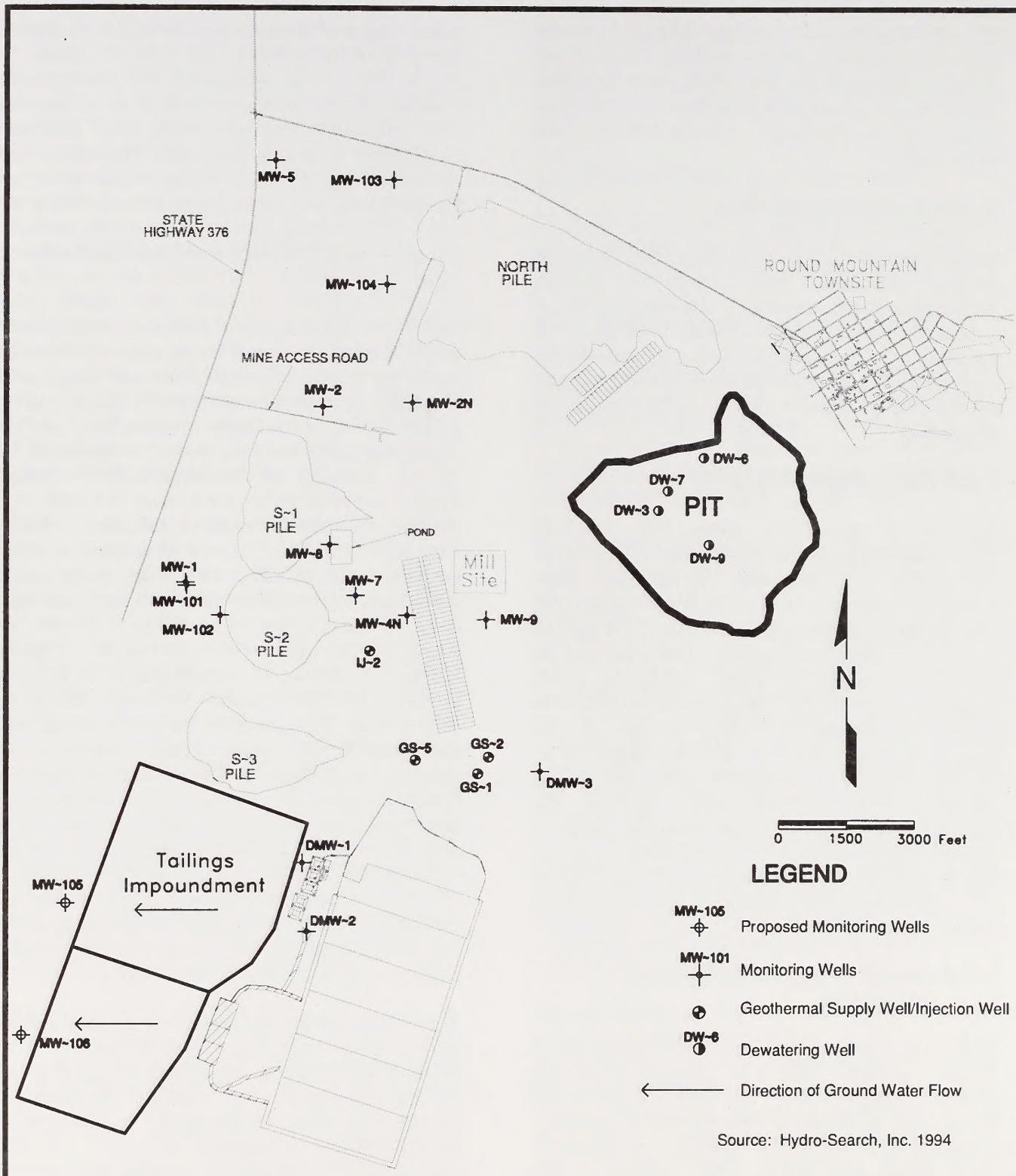
Because of component siting, the proposed reclamation and closure plans, and the location of the project in an enclosed hydrographic basin, cumulative effects from the proposed action are anticipated to be minimal. Since impacts to waters of the state are not anticipated, there should be no cumulative impacts to water quality from the proposed action or alternatives. Impacts from mine dewatering drawdown are localized and do not overlap major ground water extraction areas in the Big Smoky Valley associated with agricultural, industrial, and municipal uses. Therefore, the cumulative drawdown impacts should be minimal. Long-term cumulative impacts may occur from the tailings impoundment alternative if natural channel migration affects the integrity of drainage control features in that area.

3.2.4 Monitoring and Mitigation Measures

The SVCO collects hydrologic information on a periodic basis as part of its ongoing monitoring program. The hydrologic monitoring is performed to maintain a seasonal ground water chemistry database and report any changing conditions in water levels and quality. The locations of the existing monitoring wells are presented in ***Figure 3-10***. The current monitoring program includes monitoring wells located downgradient of the leach offload piles, reusable leach pads, and dedicated heap-leach facilities. As part of the proposed project, water quality monitoring would be expanded to include monitoring wells located downgradient of the tailings impoundment and associated process solution ponds. The proposed locations of these monitoring wells are shown in ***Figure 3-21***. It is anticipated that the Nevada Division of Environmental Protection will require this additional monitoring for the proposed modification of the mine permit. Therefore, it is anticipated that the Nevada Division of Environmental Protection would be responsible for approving the location, design, sampling protocol, schedule, and reporting requirements for these wells.

Under the current mine permit and proposed modifications to the mine permit resulting from the proposed action, samples from all designated water quality monitoring wells would continue to be collected on a quarterly basis. For all the monitoring wells, samples would be analyzed for Nevada Division of Environmental Protection Profile I constituents for a minimum of 1 year, and indicator parameters would be selected for future analyses thereafter. Samples of spent ore would continue to be collected as the ore is off-loaded from the south reusable leach pad on a quarterly basis. These spent ore samples would be subjected to the Meteoric Water Mobility Procedure and would be analyzed for Nevada Division of Environmental Protection Profile II constituents. The results of the water quality and spent ore sample testing would continue to be submitted to the Nevada Division of Environmental Protection on a quarterly basis. In addition, water level measurements would be recorded in all available monitoring wells and piezometers used to calibrate the numerical flow model. Characterization data collected over the year would also be compared to the existing water quality database for the mine in an annual report to the Nevada Division of Environmental Protection.

The SVCO will monitor the pit lake water quality during mine reclamation and closure. Under Nevada law, postclosure monitoring would be required to demonstrate that the existing and proposed facilities do not have the potential to degrade waters of the state. In addition, Nevada law prohibits the creation of pit lakes that have the potential to degrade the waters of the state or the potential to adversely affect human health or terrestrial and avian life (Nevada Administrative Code 445.2435). As a result, pit lake water quality monitoring will be required by the Nevada Division of Environmental Protection as part of postclosure monitoring requirements to demonstrate that the pit lake will not have the potential to adversely



Note: Although RMGC has changed four of the well numbers, the numbers used here are consistent with Hydro-Search, Inc. reports (1993, 1994). For reference, both numbers are provided below:

Hydro-Search, Inc.	RMGC
MW-1	GMW-1
MW-2	GMW-2
MW-2N	MW-2
MW-4N	MW-4

Round Mountain Mine

Figure 3-21

Proposed Ground Water Monitoring in Vicinity of Tailings Facility

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affect waters of the state or terrestrial or avian life (Zimmerman 1995).

WR-1: Numerical modeling indicates that the Round Mountain townsite water supply well could potentially be impacted by de-watering drawdown. Potential impacts to this water supply well would be minimized by monitoring water levels and mitigating any adverse effects to the water supply. The SVCO would be responsible for establishing monthly monitoring and mitigating adverse effects by lowering the pump, deepening an existing well, drilling a replacement well, or providing a replacement water supply of equivalent yield and general quality during the period of effect.

WR-2: At closure, no seepage through the tailings underdrain system is expected, and the collection pond is anticipated to be dry. However, if tailings solution were still seeping through the underdrain system after the cessation of mine processing operations, the seepage would create a potential concern. This potential impact would be eliminated by backfilling and reclaiming the pond after all seepage from the underdrain system had ceased.

WR-3: Impermeable siltation berms would be placed at depressional areas along the outer faces of the offload piles to restrict the extent of runoff migration. Areas collecting or conveying runoff flows from the leach offload piles would be kept barren of vegetation or fenced during operations to prevent use by livestock and wildlife. Currently, these areas are anticipated to include any depressional areas at event discharge points and pond areas at existing and proposed sedimentation/infiltration structures (as indicated on the map included in RMGC's Stormwater Pollution Prevention Plan of December 14, 1993).

During the reclamation phase, placement of growth media, successful revegetation, and erosion control would generally limit the concentrations of leachate constituents in runoff, and would restrict the plant uptake of such constituents caused by soil attenuation. To further limit the potential for plant uptake, a minimum of 3 feet of growth media would be placed in any area that collects runoff from the piles.

3.2.5 Residual Adverse Effects

A potential adverse impact to ground water quantity is the possible drawdown of the Round Mountain townsite water supply well. If this well is impacted, it is anticipated that the SVCO would ensure the provision of an alternate supply to mitigate the impacts; therefore, there would be no residual adverse effects to water resources. The pit lake would not discharge to surface or ground water; therefore, adverse impacts to waters of the state are not anticipated. A risk assessment of potential pit water quality impacts to birds and terrestrial wildlife has been performed (PTI 1995a), and the details of the risk assessment and potential impacts to wildlife are presented in Section 3.5, Wildlife and Fisheries Resources.

3.3 Soils and Watershed

3.3.1 Affected Environment

The following soils information for the proposed mill and tailings facility is based on detailed soil mapping, a profile description, and sampling conducted by ERT (ERT 1987b). Soils information for the alternative tailings impoundment site is based on recent detailed mapping conducted by Riverside Technology, inc. Soils information for the cumulative impact area is taken from the Soil Survey of the Big Smoky Valley Area published by the Soil Conservation Service (Candland 1980). The soils map of the project area is presented in ***Figure 3-22.***

The project area lies within the Great Basin section of the Basin and Range Physiographic Province (Peterson 1981). In this area, alluvial basins are bordered by steep mountain ranges with smaller local isolated mountains and hills. In general, shallow rocky soils occur in the mountainous areas, with moderately deep and deep coarse-textured soils occurring downslope on colluvial ridge sideslopes, alluvial fans, and fan aprons. Both the proposed mill site and the proposed tailings facility site lie on an alluvial fan on the western slope of the Toquima Range, which is on the eastern side of the Big Smoky Valley.

3.3.1.1 Watershed

The Big Smoky Valley forms a semi-enclosed basin, trending north-northeast by south-southwest. The project area is located near the southern end of the northern portion of the basin, which is internally drained. The Nevada State Engineer has designated the northern portion of the basin "watershed 137B;" the southern portion, which includes the mining areas around the former townsite of Manhattan, is designated as "watershed 137A."

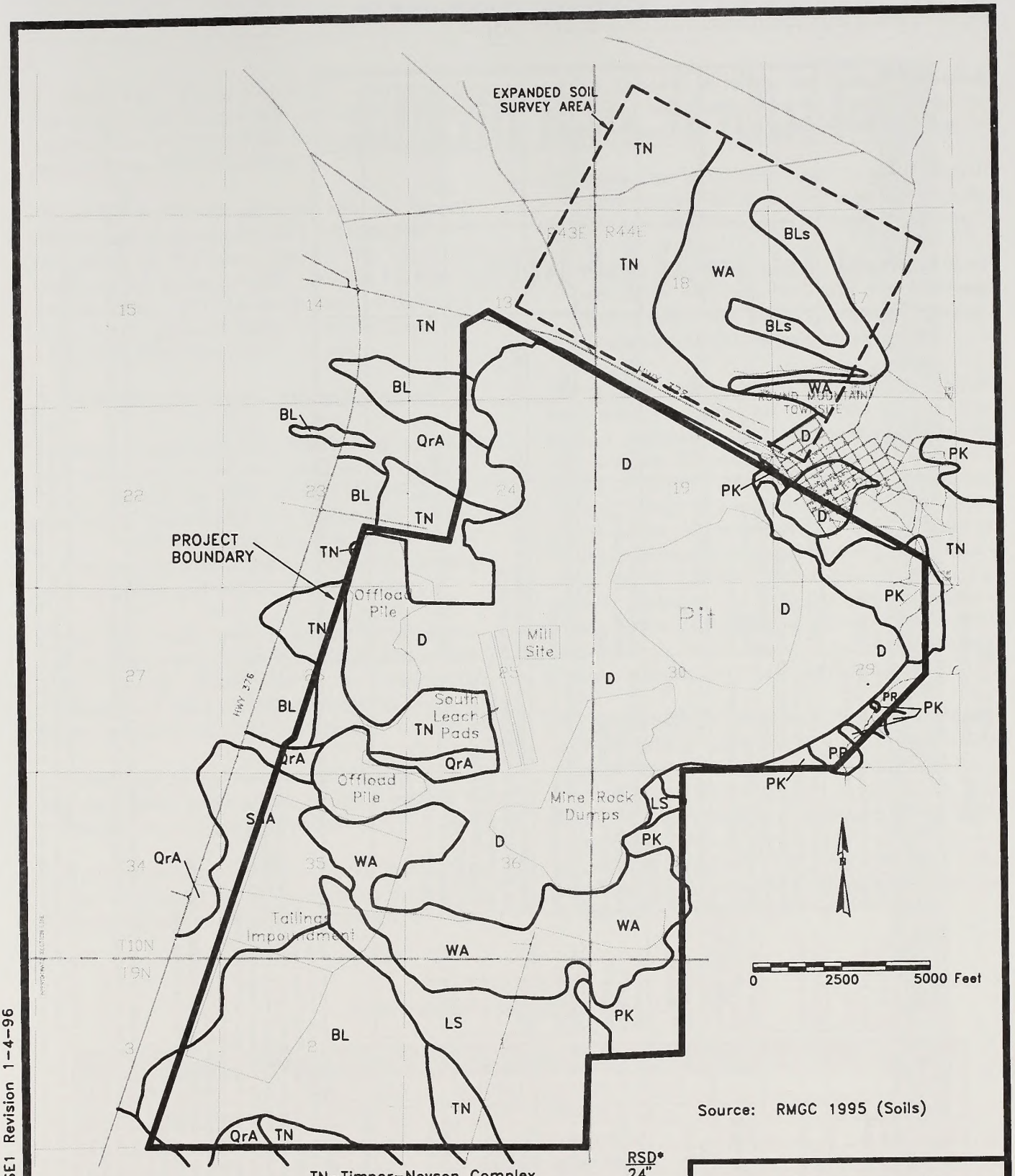
The project area is drained by numerous ephemeral drainages that originate in the Toquima Range to the east and terminate within the Big Smoky Valley, which slopes gently downward to the north. When these ephemeral drainages flow, they carry precipitation runoff that normally infiltrates the alluvial fans before it reaches the valley floor. The surface drainage of the project site displays a shallow, braided, dendritic pattern typical of alluvial fans near mountain faults in the Basin and Range Province (SHB AGRA 1994a). The locations of many small, ephemeral drainages in the project area are shown on the soils map, ***Figure 3-22.***

3.3.1.2 Soils

Table 3-13 summarizes the soil map unit characteristics and reclamation suitabilities of the project area. On the proposed mill site, two soils previously occurred in one map unit—the Timper-Noyson Complex, map unit TN (ERT 1987b). The shallow Timper soil has coarse sandy loam texture in both the surface and upper subsoil layers that overlies a white, silica-lime cemented duripan (hardpan) beginning at 12 to 20 inches. The duripan is a root-limiting layer and is the reason the Timper soil is considered shallow. The moderately deep Noyson soil has loamy coarse sand over a cemented duripan beginning slightly deeper at 20 to 36 inches. Permeability is rapid down to the hardpan layer, but very slow through it. The wind erosion hazard is high.

Some of the soil on the proposed mill site has been previously disturbed, and a portion is currently in an erosion control berm on the site. This soil is still available to be used in future reclamation activities, as are small adjacent areas of undisturbed soil on the site. Although the proposed mill site is shown on the soil map, ***Figure 3-22***, as Disturbed/Developed (map unit D), at least 12 inches of suitable soil material remain on the site.

On the proposed tailings facility site, four soils occur—Stumble, Wardenot, Laxal, and Bluewing. The Stumble soil (map unit SuA) is found on small aeolian deposits on alluvial fan surfaces. Stumble is very deep and has calcareous loamy coarse sand texture with up to 20 percent gravel content. Typically, hardpan is not encountered within the first 6 feet. The Wardenot soil (map unit WA) typically has a 6-inch gravelly sandy loam surface layer over very gravelly sandy loam to loamy sand to a depth of 6 feet or more. The gravel content ranges from 20 to just over 40 percent. The deep Laxal soil (map unit LS) has an approximate 14-inch channery sandy loam surface and upper subsoil layer overlying extremely channery loamy sand to a depth of 6 feet or more. The coarse fragment content ranges from approximately 40 percent in the surface to 70 percent throughout the rest of the soil profile. The very deep Bluewing soil (map unit BL) is present in very gravelly alluvium derived from mixed rocks. Typically, the surface layer is a gravelly loamy sand approximately



	RSD*
TN–Timper–Noyson Complex	24"
BL–Bluewing	12"
BLs–Bluewing, Stony Phase	0"
QrA–Quima	18"
PK–Pintwater–Rock Outcrop Complex	0"
PR–Pumel–Rock Outcrop Complex	0"
SuA–Stumble	12"
WA–Wardenot	12"
LS–Laxal	12"
D–Disturbed/Developed Area	0"

*Recommended Soil Salvage Depth

Round Mountain Mine

Figure 3-22

Soils Map

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TABLE 3-13
Soil Map Unit Characteristics

Map Unit Number	Map Unit Name[1]	Percent of Map Unit	Inclusions Within Map Unit	Slopes and Terrain[2]	Parent Material Type[3]	Erosion Hazard of Bare Surface Water[4]	Erosion Hazard of Bare Surface Wind[4]	Range Site[5]	RSD[6] (inches)	Limiting Factors
BL	Bluewing gravelly coarse sandy loam, 0-8% slopes	85	Bluewing 15% stony surface (BLs)[7]	Nearly level to moderately sloping very irregularly shaped areas on alluvial fans that have small, dry washes 1 to 4 feet deep	Very gravelly alluvium from mixed rocks	Slight	High	Sandy loam 5-8" (29-46)	12	High % of coarse fragments
LS	Laxal very channery coarse sandy loam, 0-8% slopes	90	Alluvial material 10% in washes	Nearly level to moderately sloping very deep soils on irregularly shaped areas on alluvial fans that have been dissected by dry washes 1 to 4 feet deep	Very shaly alluvium derived from inter-bedded micaceous shale, limestones, and quartzite	Slight	High	Loamy 5-8" (29-17)	12	High % of coarse fragments (60 - 75%)
PK	Pintwater- Rock Outcrop Complex, 15-50% slopes	50 30	Minor inclusions 20% (Old Camp, Malpais, and Roic)	Moderately steep and steep shallow soils on foothills and mountain slopes	Colluvium from volcanic rhyolitic rocks	Moderate	High	Sodic hill 5-8" (29-22)[8]	0	Rock outcrop
PR	Pumel-Rock Outcrop Complex, 4-50% slopes	60 25	Bluewing 10% (in dry washes) Pintwater 5%	Gently sloping to strongly sloping very shallow soils and rock outcrop on rounded, undulating to rolling hills and pediments	Colluvium derived mainly from granodiorite	Moderate	High	Sodic hill 5-8" (29-22)[8]	0	Rock outcrop
QrA	Quima gravelly coarse sandy loam, 0-4% slopes	85	Bluewing 5% Koyen 5% Stumble 5%	Nearly level to gently sloping very deep soils on large, broad, smooth to undulating areas on alluvial fans	Alluvium derived from granite, rhyolite, tuff, and ash	Slight	High-Very High	Sandy loam 5-8" (29-46)	18	High sodicity below 18 to 30"
SuA	Stumble loamy coarse sand, 0-2% slopes	85	Bluewing 10% Quima 5%	Nearly level very deep soils on alluvial fans and sand sheets	Alluvium from mixed rock sources	Slight	High	Sandy 5-8" (29-12)	12	Too sandy below 12"
TN	Timper- Noyson gravelly coarse sandy loams Complex, 0-8% slopes	50 40	Bluewing 10%	Nearly level to gently sloping soils that are shallow (Timper 12 to 20") and moderately deep (Noyson 20 to 36") to a strongly cemented hardpan. They are on alluvial fans.	Alluvium mostly from mixed volcanic rocks	Slight	Very High	Loamy 5-8" (29-17)	24	Cemented hardpan below 24" (avg.)
WA	Wardenot gravelly coarse sandy loam, 0-8% slopes	85	Bluewing 10% Quima 5%	Nearly level to moderately sloping very deep soils on alluvial fans	Alluvium from mixed rocks	Slight	High	Loamy 5-8" (29-17)	12	High % of coarse fragments, high sodicity
D	Disturbed/developed area (topsoil has been previously salvaged)								0[9]	No soil

[1] Taxonomic classifications for soil series components of map units:

Bluewing	Sandy-skeletal, mixed, mesic Typic Torriorthent (deep)
Laxal	Loamy-skeletal, mixed (calcareous), mesic Durorthidic Torriorthent (deep)
Pintwater	Loamy-skeletal, mixed (calcareous), mesic Lithic Torriorthent (shallow)
Pumel	Loamy-skeletal, mixed (calcareous), mesic, shallow Typic Torriorthent
Quima	Coarse-loamy, mixed, mesic Typic Camborthid (deep)
Stumble	Mixed, mesic Typic Torripsamment (deep)
Timper	Loamy, mixed, mesic, shallow Entic Durorthid
Noyson	Coarse-loamy, mixed, mesic Entic Durorthid (moderately deep)
Wardenot	Sandy-skeletal, mixed, mesic Typic Torriorthent (deep)

[2] Terminology from Soil Conservation Service 1981.
[3] Terminology from Soil Conservation Service 1981.
[4] Water erosion hazard class taken from Soil Conservation Service Official Soil Series Descriptions; wind erosion hazard class from the Soil Conservation Service National Soils Handbook (1983).
[5] Range site taken from current Soil Conservation Service data (major land resource area 29, Southern Nevada Basin and Range). The Soil Conservation Service Soil Survey of Big Smoky Valley, Part of Nye County (Candland 1980), was used for map units PK and PR.
[6] RSD - recommended suitable soil salvage depth.
[7] Bluewing stony surface phase has a recommended salvage depth of 0 because of a high percentage of cobbles, stones, and boulders on the surface and throughout the soil profile.
[8] Although the name for Nevada range site 29-22 is "Sodic hill," the site-specific data for Round Mountain soil units PK and PR do not indicate high sodicity.
[9] Although the proposed mill site is shown on the soil map as Disturbed/Developed (Map Unit D), at least 12 inches of suitable soil material remain on the site.

3 inches thick. Below this depth, very gravelly loamy sand extends to 6 feet or more. The coarse fragment content below 2 feet in depth ranges from approximately 60 to 75 percent.

On the alternative tailings facility site, the Timper-Noyson complex (map unit TN) occupies the lower fan areas on the west side of the site. The Wardenot soil (map unit WA) occupies the rest of the site except for three small areas of Bluewing, stony phase, generally along Shoshone Creek and a tributary on the east side of the site.

3.3.2 Environmental Consequences

Impacts to soils could occur during mining when soils are salvaged and stockpiled, as well as after mining between the time the final topsoil (growth medium) is redistributed and reclamation is completed. Potential impacts to soil resources would include soil loss and/or change in productivity as a result of mining and reclamation activities.

Project area soils were evaluated to determine their suitability and depth for salvage and subsequent use as growth media for reclamation purposes. The wind and water erosion potential of project area soils was also determined.

The following paragraphs contain general criteria that were used in evaluating possible impacts to soil resources during project activities.

Soil reclamation and erosion potential are primary issues considered in the significance criteria for potential impacts to soils and watershed. Environmental impacts to soils and watershed were considered significant if the proposed action or selected alternative could result in the following:

- Major loss of suitable soils or other growth media during salvage, stockpiling, or reclamation activities limiting reclamation success
- Erosion of disturbed or reclaimed sites preventing the effective use of sediment control structures, blocking natural drainages, or not supporting revegetation efforts

The soils and other growth media on the project area were evaluated for suitability, depth, and erosion potential based on current, commonly accepted soil salvageability criteria for hard rock mining in Nevada. Although the recently enacted Nevada Division of Environmental Protection regulations concerning reclamation of lands subject to mining operations discuss removing and stockpiling topsoil (section 519A.325), there is no current published Nevada Division of Environmental Protection guideline listing soil suitability criteria for use in soil salvage operations (Nevada Division of Environmental Protection 1992).

The recent BLM *Solid Minerals Reclamation Handbook H-3042-1* (BLM 1992b) contains a soil suitability table (Table XII-1, page XII-2) that was used to evaluate this project. According to this table, the parameters and threshold value limits presented in ***Table 3-14*** constitute a poor rating for reclamation potential. For this project, soils exhibiting a poor rating were considered unsuitable for salvage and reclamation.

TABLE 3-14
BLM Threshold Values for Poor Soils

Parameter	Factor
Sodium Adsorption Ratio (SAR:)	8 to 16 (excess sodium)
Electrical Conductivity (EC):	7 to 15 (excess salt)
pH:	4.5 to 5 (too acidic)
	8.5 to 9 (too alkaline)
Soil Texture:	Sandy clay, loamy sand, and silty clay; clay greater than 60 percent is considered unsuitable
Coarse Fragments:	20 to 40 percent, with greater than 40 percent considered unsuitable

Source: BLM 1992b

Although not specifically stated in the BLM suitability table, unsuitable coarse fragments (greater than 40 percent by volume) are primarily cobbles (3 to 10 inches in diameter) and stones (greater than 10 inches). Based on other sources, up to 50 or 60 percent of gravels (2 millimeters to 3 inches in diameter) is generally considered suitable. In addition, a very hard or extremely hard soil consistency would limit soil salvage and is considered in the suitability parameters for this project. For example, a cemented hardpan (duripan) has extremely hard, dry soil consistency and limits soil salvage once encountered.

Poorly rated materials have such severe problems that revegetation and stabilization are very difficult and costly. Soil reapplication with better material is necessary to establish and maintain vegetative growth.

In addition, severe soil erosion potential could be considered a significant impact. Coarse, fine, and very fine sands are rated extremely erodible (up to 310 tons per acre per year); fine and very fine loamy sands are rated very highly erodible (up to 134 tons per acre per year); and coarse, fine, very fine sandy loams are rated highly erodible (up to 86 tons per acre per year) (Soil Conservation Service 1983). Lower soil loss potentials (up to 38 tons per acre per year) could occur on silty and noncalcareous silty loam soils. The Soil Conservation Service has set a guideline for soil loss on shallow soils (less than 20 inches to bedrock or unfavorable strata) at 1 ton per acre per year. This guideline is based on the maximum amount of erosion that a soil as a medium for plant growth can tolerate without loss of quality.

As part of the erosion evaluation, water erosion potential predicted by the Revised Universal Soil Loss Equation was considered (Soil and Water Conservation Society 1992). The threshold for significant soil loss is similar to that for wind erosion loss (1 ton per acre per year for shallow soils).

The soil evaluations were based on the field descriptions of each soil series and mapping unit, as well as limited physical and chemical data. Salvage depths for a particular soil series were generated based on average depths of suitable material or average profile depth if the entire profile was suitable. Each map unit was given a salvage depth recommendation that represents suitable material. Material that was rated poor (***Table 3-14***) was not recommended for salvage.

3.3.2.1 Proposed Action

The construction and operation of the proposed action (mill, tailings facility, and associated structures) would result in the disturbance of approximately 757 acres, 250 of which are outside the existing permit boundary. The locations of suitable topsoil (growth medium material) with corresponding recommended average salvage depths for the proposed disturbance areas are identified in ***Figure 3-22***. The recommended soil salvage depths and limiting factors for each map unit are listed in ***Table 3-13***. For this alternative, the average depth of suitable growth medium across all proposed disturbance areas is 11.8 inches, with suitable salvage depths ranging from 0 to 18 inches, depending on the soil characteristics at a particular location. ***Table 3-15*** lists the acres of disturbance by facility and soil map unit and gives inches and volumes of available topsoil for redistribution over each disturbance area.

Replacement of plant growth media is proposed for major disturbances associated with the proposed project. Growth media would consist primarily of salvaged native soil materials combined with pit-run alluvium as needed. Adequate volumes of these materials exist on the project site. The pit-run alluvium is chemically suitable for plant growth, but may have some physical limitations because of texture coarseness (grain size distribution). The use of pit-run alluvium alone as a seedbed material would cause additional moisture stresses on reseeded plant species beyond the effects of the rainfall limitations at the site. Revegetation efforts may be hampered as a result. However, for the stated land use goals, such conditions would not result in a significant decrease in soil productivity from the existing undisturbed conditions. In addition, the creation of seedbeds composed solely of pit-run alluvium may be avoided by judicious handling and placement of plant growth media.

Plant species and growth media are currently being tested for reclamation success, and testing will continue into the future (Badame 1994). The results of this program will be used to further specify reclamation practices. Although not identified as a mitigation measure in and of itself, it would be beneficial to investigate the potential use

TABLE 3-15
Growth Medium Volume - Proposed Action

Area	Soil Mapping Unit	Acres	RSD[1]	Soil Volume[2]
Within the Existing Permit Area				
Proposed Tailings Impoundment	D	12	0.0	0
	WA	102	12.0	164,560
	QrA	2	12.0	4,840
	LS	41	12.0	66,147
	BL	78	12.0	125,840
	SuA	131	12.0	211,347
	Total	**366**	**11.6**	**572,734**
Proposed Process Ponds	SuA	5	12.0	8,067
	QrA	5	18.0	9,680
	Total	5	**14.7**	**17,747**
Proposed Pipeline	WA	0.4	12.0	645
	D	1.6	0.0	0
	Total	2	**2.2**	**645**
Proposed Mill Site	D	50	12.0[3]	80,667
	Total	50	12.0	**80,667**
Proposed Transmission Line Spurs	WA	2.9	12	4,679
	D	1.2	0	0
	SuA	0.9	12	1,452
	Total	**5**	**9.2**	**6,131**
Proposed Haul Road	D	1	12[4]	1,613
Proposed Growth Medium Stockpiles	- - -	74	0[5]	0
Proposed Action Total		**507**	**10.0**	**679,537**
Within the Proposed Permit Expansion Area				
Proposed Tailings Impoundment	BL	171	12.0	275,880
	SuA	78	12.0	125,840
	Total	**249**	12.0	**401,720**
Proposed Process Ponds	QrA	1	12.0	2,420
	Total	5	12.0	**2,420**
Proposed Pipeline Ditches	--	5	--	--
Proposed Mill Site	--	5	--	--
Proposed Action Total		**250**	**12.0**	**404,140**
Proposed Action Grand Total (existing permit area and proposed permit expansion)		**757**	**11.8**[6]	**1,083,677**

[1] RSD = recommended soil salvage depth in inches.
[2] Soil volume in cubic yards, rounded to nearest cubic yard.
[3] Although the proposed mill site has been previously disturbed, a site-specific evaluation indicates an average of 12 inches of suitable soil remains on that site.
[4] Although the proposed haul road site has been previously disturbed, a site-specific evaluation indicates an average of 12 inches of suitable soil remains on that site.
[5] Soil will not be salvaged beneath the growth medium stockpile locations.
[6] 11.8 inch RSD is an average of all areas to be salvaged (683 acres of the 757 acres within the proposed action). Estimates do not include the 74 acres of growth medium stockpiles beneath which soil will not be salvaged.

of fertilizers during the operational phase of the proposed project. The use of fertilizers may or may not improve plant growth and establishment because the amount and frequency of precipitation may be inadequate to sufficiently solubilize fertilizers within a reasonable timeframe. In addition, the application of fertilizers that contribute to soil salinity or alkalinity should be avoided.

The use of fertilizers could be incorporated into the existing reclamation efforts and further analyzed as mining activities in the area progress.

Predicted soil losses for the proposed action are shown in ***Table 3-16.*** These estimates were derived by applying the Revised Universal Soil Loss Equation to proposed site conditions and seedbed materials over the reclamation timeframe as described in the *Plan of Operations Amendment.* In general, the predicted soil losses are within annual tolerances, indicating that for most of the reclaimed site, erosion would not significantly limit reclamation efforts. Over the large area occupied by the proposed tailings surface, proposed reclamation may actually improve soil stability (and possibly productivity) beyond the native condition.

As part of reclamation activities, a proposed 10-inch depth of scarified growth medium would be placed over the embankment faces. The embankment materials could also be expected to provide some plant growth benefits at greater depths. According to the *National Soils Handbook* (Soil Conservation Service 1983), the annual soil loss tolerance for such conditions would be 1 ton per acre per year in a climate-restricted setting such as the proposed project site. As shown in ***Table 3-16***, accelerated erosion would occur if salvaged topsoil were to be placed on the 2.5:1 embankment faces during reclamation without implementing mitigation measures. Predicted soil losses from sheet and rill erosion on this area under the proposed action range from 4.3 to 7.6 tons per acre per year for topsoil materials. These levels of accelerated erosion would occur on approximately 100 acres of tailings embankment faces after life-of-project closure. For these areas, additional mitigation measures are recommended to minimize accelerated erosion of the plant growth media and to encourage revegetation.

Potential soils impacts associated with runoff from the leach offload piles are discussed in Section 3.2.2.1; mitigation for these impacts is identified in Section 3.2.4.

TABLE 3-16
Predicted Soil Losses

Landscape Position and Surface Material	Reclamation Timeframe	Slope (%)	Length (feet)	Erosion Rate (ton/acre/year)
Undisturbed Fan Surface		4	300	0.17
Tailings Embankment Face				
A. Pit-Run Alluvium	1. Right after seeding	40	150	0.35
		40	300	0.62
	2. 6 mo. - 1 yr. after seeding	40	150	0.10
		40	300	0.14
B. Salvaged Topsoil (growth medium material)	1. Right after seeding, no mulch	40	150	4.3
		40	300	7.6
	2. Right after mulching and seeding	40	150	1.3
		40	300	2.3
	3. 6 mo. - 1 yr. after seeding, no mulch	40	150	0.95
		40	300	1.3
Reclaimed Tailings Surface				
A. Pit-Run Alluvium	1. Right after seeding	2	1,000	0.02
	2. 6 mo. - 1 yr. after seeding	2	1,000	0
B. Salvaged Topsoil (growth medium material)	1. Right after seeding	2	1,000	0.31
	2. 6 mo. - 1 yr. after seeding	2	1,000	0.04

Note: There is no site-specific laboratory data for pit-run alluvium particle size. Geotechnical logging for these materials classified them mainly as Unified GP (poorly-graded gravel). Assume very gravelly loamy sand texture for pit-run alluvium and 0.1 for corresponding K value. Soil Conservation Service personnel thought 0.1 was appropriate for deep alluvial fan materials.

By implementing the suggested mitigation measures identified in this environmental impact statement in addition to the reclamation program as proposed in the *Plan of Operations Amendment*, impacts to soils and watershed resulting from the proposed action would not be considered significant.

3.3.2.2 Range Management Alternative

Soil salvage depths and volume calculations are similar to those for the proposed action. Soil would not be salvaged along the two proposed fence lines, and no impacts to soils from fence construction are anticipated. Vegetation would improve, thereby reducing soil erosion and the impacts of the current overuse and the increased overuse that would occur with the proposed action alone. The impacts associated with the range management alternative would be less than the proposed action.

3.3.2.3 Tailings Impoundment Alternative

This alternative would result in the disturbance of approximately 452 acres through the life of the project. The location of suitable topsoil (growth medium material) with corresponding recommended average salvage depths for the alternative disturbance areas is identified in ***Figure 3-22***. The recommended soil salvage depths and limiting factors for each map unit are listed in ***Table 3-13***. For this alternative, the average depth of suitable topsoil (growth medium material) across all disturbance areas is 16.7 inches, with suitable salvage depths ranging from 0 to 24 inches, depending on location. ***Table 3-17*** lists the acres of disturbance by facility and soil map unit and indicates inches and volumes of available topsoil growth medium material for redistribution over each disturbance area. The soils and watershed impacts associated with the tailings impoundment alternative would be the same as the proposed action.

TABLE 3-17
Growth Medium Volume - Tailings Impoundment Alternative

Area[1]	Soil Mapping Unit	Acres	RSD[2]	Soil Volume[3]
Within the Existing Permit Area				
Alternative Tailings Impoundment	--	0	--	--
Alternative Process Ponds	--	0	--	--
Alternative Pipelines	TN	3.5	24	11,293
	BL	2	12	3,227
	QrA	3.5	18	8,470
	D	4	0	0
	Total	**13**	**13.2**	**22,990**
Alternative Tailings Impoundment Total		**13**	**13.2**	**22,990**
Outside the Existing Permit Area				
Alternative Tailings Impoundment	TN	168	24	542,080
	WA	231	12	372,680
	BLs	17	0	0
	Total	**416**	**16.4**	**914,760**
Alternative Process Ponds	TN	10	24	32,267
	Total	**10**	24	**32,267**
Alternative Pipelines	TN	12	24	38,720
	WA	1	12	1,613
	Total	**13**	**23.1**	**40,333**
Alternative Tailings Impoundment Total		**439**	**16.8**	**987,360**
Alternative Tailings Impoundment Grand Total (existing permit area and proposed permit expansion)		**452**	**16.7**	**1,010,350**

[1] The location of the mill site remains the same in both the proposed action and the alternative tailings impoundment. The topsoil volume evaluation for the mill site is included with the proposed action and not additionally listed in this table.
[2] RSD = recommended soil salvage depth in inches.
[3] Soil volume in cubic yards, rounded to nearest cubic yard.

3.3.2.4 No Action Alternative

The additional disturbance to soils associated with the proposed expansion would not occur with the no action alternative. The SVCO would continue to implement the soil mitigation and monitoring measures required in the existing permits. The no action alternative would result in reclamation of permitted disturbances as approved in the current SVCO *Plan of Operations*.

3.3.3 Cumulative Impacts

Past, present, and reasonably foreseeable future actions in the vicinity of the Round Mountain Mine were examined with respect to cumulative soils and watershed impacts. The future actions include the SVCO's future dedicated pad sites shown in ***Figure 2-10***.

The disturbances to soil resources associated with the past and current operations at the Round Mountain Mine are approximately 4,767 acres. An additional 290 acres would potentially be affected by reasonably foreseeable expansion activities beyond the proposed action.

Past mining operations and other disturbances in the vicinity that have affected soil resources include approximately 342 acres at Gold Hill, 3,409 acres at Manhattan, 385 acres at Jefferson Canyon, and 269 acres on the west slope at Barcelona (i.e., in the Big Smoky Valley). In total, approximately 4,405 acres have been previously disturbed in the vicinity surrounding Round Mountain.

Including the proposed 757 acres of additional disturbance and the 290 acres of additional disturbance reasonably foreseeable at Round Mountain, cumulative disturbance to soil resources in and around Round Mountain would amount to approximately 10,219 acres. This acreage total represents a very small portion of the total acres in the Big Smoky Valley. Thus, it is concluded that cumulative impacts to soil resources are not significant.

3.3.4 Monitoring and Mitigation Measures

Potential impacts to soils and watershed resources would be substantially mitigated by reclamation practices included as part of the proposed action. Proposed monitoring and mitigation measures generally follow those identified for soils in the *Solid Minerals Reclamation Handbook* (BLM 1992b) as appropriate.

Additional mitigation measures recommended to improve reclamation effectiveness include the following:

S-1: Shallow ripping or other surface treatment should be implemented to create roughness on the tailings embankment faces prior to the placement of growth media. This would improve the stability of replaced growth media with regard to the embankment materials.

S-2: Growth media placed on the tailings embankment face should be limited to suitable materials from the pit-run alluvium sources. Placement of more erodible topsoil materials on long, steep slopes should be avoided.

S-3: Contour ripping techniques should be applied elsewhere on the project area to minimize erosion.

S-4: The reclaimed site should be monitored by visually inspecting flow channels, fencing, drainage and erosion controls, and slope stability until reclamation has final approval. Maintenance and/or corrective measures should be taken, as necessary, during the monitoring period.

3.3.5 Residual Adverse Effects

Soils and watershed impacts would be mitigated by natural soil development over time, assuming successful reclamation. Furthermore, reductions in soil productivity could be reversed within 5 to 15 years assuming successful reclamation. If reclamation were not successful, long-term adverse impacts would result.

3.4 Vegetation

3.4.1 Affected Environment

3.4.1.1 Plant Communities

Several desert shrub communities occur in the vicinity of the Round Mountain Mine; however, only two occur in the proposed permit expansion area in Section 35, T10N, R43E, and Sections 2 and 3, T9N, R43E. These communities, shadscale and fourwing saltbush, have been characterized in earlier environmental assessments conducted at the project site (ERT 1987a, BLM 1992a). A third plant community, dominated by Bailey greasewood, occurs over the majority of the alternative tailings impoundment location north of the project site.

Shadscale. The shadscale community is common throughout the Big Smoky Valley and occupies level to gently sloping alluvial fans extending from the adjacent mountain ranges. The dominant shrub species include shadscale and bud sagebrush. Associated shrubs include Bailey greasewood, Nevada ephedra, spiny hopsage, rabbitbrush, and fourwing saltbush. Associated understory grasses include bottlebrush squirreltail, galleta, Indian ricegrass, and bluegrass. Total plant cover in this community ranges from approximately 17 to 30 percent. Within the proposed permit expansion area and alternative tailings impoundment area, this community occupies west-facing alluvial fans with loamy to sandy-loam soils.

Fourwing Saltbush. The fourwing saltbush community occupies nearly level valley bottom areas adjacent to State Highway 376 west of the proposed project site. The dominant shrub species include fourwing saltbush, winterfat, bud sagebrush, and rabbitbrush. Associated shrub species include spiny hopsage, littleleaf horsebrush, Nevada ephedra, and pricklypear. Associated understory species include Indian ricegrass and buckwheat. Total plant cover in this community ranges from approximately 17 to 30 percent. Within the proposed permit expansion area, winterfat appears to be more abundant in this community than may be typical of other areas around the mine.

Greasewood. The greasewood vegetation type occurs on level to gently sloping alluvial fans. This type is characterized by the dominance of Bailey greasewood with associated shrub species, including bud sagebrush and shadscale. Less common shrub species are Nevada ephedra, rabbitbrush, and fourwing saltbush. Common understory species include bottlebrush squirreltail, galleta, Indian ricegrass, bluegrass, and buckwheat. Total plant cover in this community ranges from approximately 20 to 40 percent.

Community Characteristics Within the Proposed Project Area. The above plant communities correspond roughly to Soil Conservation Service range sites of loamy (5 to 8 inches), sandy loam (5 to 8 inches), and gravely loam (5 to 8 inches), respectively (Metscher 1994). Based on Soil Conservation Service range site descriptions (Candland 1980 and Soil Conservation Service 1991) and BLM observations (ERT 1987a, Metscher 1994), annual forage production for these three communities is estimated at 200 to 300, 300 to 400, and 200 to 350 pounds per acre, respectively.

Table 3-18 identifies the plant species recorded in these three communities during field investigations conducted in 1987 (ERT 1987a) and 1993 (Badame 1994). Although differences of species composition may exist within a plant community from one point to another in the project vicinity, the species listed here are generally representative of the communities as they occur in the proposed mill and tailings impoundment areas and the alternative tailings impoundment area.

The shadscale and greasewood plant communities share numerous common species and are defined in this classification by the relative abundance of the dominant shrub species that commonly occur together, rather than by the distinct presence or absence of individual species. All three communities intermingle throughout the area on the basis of soil variations, topography, and moisture availability; thus, the boundaries between them are often indistinct.

As described in Section 3.6, Range Resources, the corridor between the mine and State Highway 376 has been seriously overgrazed, and the vegetation is in a reduced seral stage.

The distribution of these and other vegetation communities within the existing and proposed permit area is presented in ***Figure 3-23***. This figure is based on the vegetation maps presented in earlier environmental assessments prepared for the mine (ERT 1987a, JBR Consultants Group

TABLE 3-18
Plant Species Observed Within the Project Area

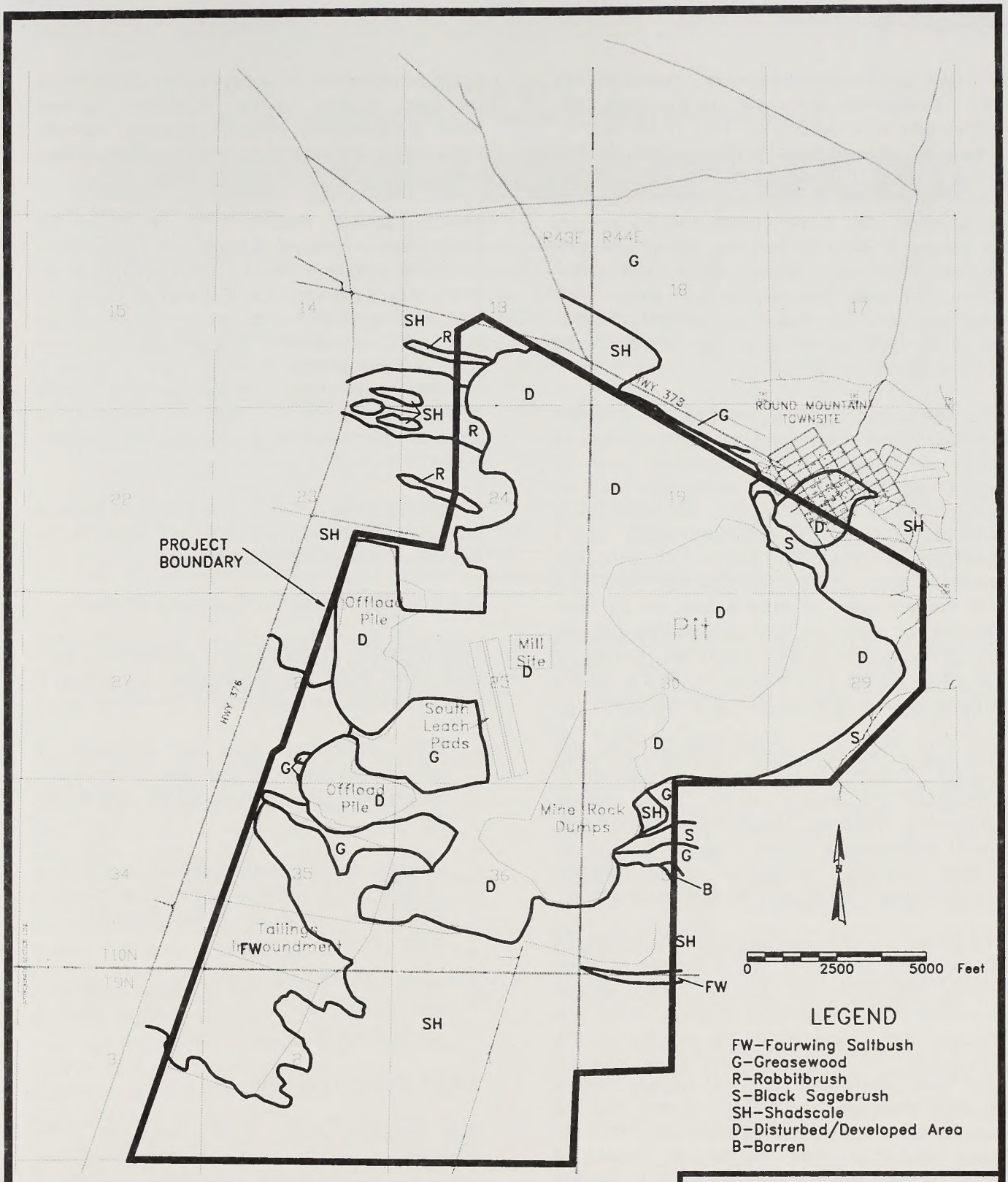
Common Name	Scientific Name	Plant Community		
		SH	GW	FW
Shrubs				
Bailey Greasewood	*Sarcobatus baileyii*	x	x	x
Bud Sagebrush	*Artemisia spinescens*	x	x	x
Fourwing Saltbush	*Atriplex canescens*	x	x	x
Littleleaf Horsebrush	*Tetradymia glabrata*	x		x
Nevada Ephedra	*Ephedra nevadensis*	x	x	x
Parry's Rabbitbrush	*Chrysothamnus parryi*	x	x	x
Pricklypear	*Opuntia* sp.	x		x
Shadscale	*Atriplex confertifolia*	x	x	
Spiny Hopsage	*Grayia spinosa*	x		x
Stickyleaf Low Rabbitbrush	*Chrysothamnus viscidiflorus*	x	x	x
Winterfat	*Ceratoides lanata*	x	x	x
Grasses				
Bluegrass	*Poa secunda*	x	x	
Bottlebrush Squirreltail	*Sitanion hystrix*	x	x	
Galleta	*Hilaria jamesii*	x	x	
Indian Ricegrass	*Oryzopsis hymenoides*	x	x	x
King Desertgrass	*Blepharidachne kingii*	x	x	
Forbs				
Buckwheat	*Eriogonum inflatum*	x	x	x
Desert Gilia	*Gilia filifolia diffusa*	x	x	
Evening Primrose	*Oenothera* sp.		x	x
Globemallow	*Sphaeralcea* sp.	x		x
Morning Brides	*Chaenactis* sp.	x	x	x
Mustard	*Brassica* sp.			x
Princesplume	*Stanleya* sp.	x	x	
Russian Thistle	*Salsola iberica*	x	x	x
Skeleton Weed	*Eriogonum deflexum*			x
Wooly Pod	*Astragalus purshii*		x	

SH = shadscale, GW = greasewood, FW = fourwing saltbush
Sources: ERT 1987a, Badame 1994

1988), with revisions to achieve reasonable consistency among mapping units between previous investigations and to more accurately depict the community distribution in the areas of the proposed and alternative tailings impoundment sites. The revisions in the area of the proposed and alternative sites were based on field observations conducted in February and May of 1994, combined with photointerpretation from 1993 aerial imagery.

3.4.1.2 Threatened, Endangered, or Sensitive Species

A search of the Nevada Natural Heritage Program database and a request to the U.S. Fish and Wildlife Service pursuant to Section 7(c) of the Endangered Species Act of 1973 did not identify the known occurrence of any threatened or endangered plant species in the vicinity of the project site. The database search did indicate that



Source: RMGC 1995 (Vegetation)

Round Mountain Mine

Figure 3-23
Vegetation Map

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one Category 2 candidate species, sanicle biscuitroot (*Cymopterus ripleyi* var. *saniculoides*), has been recorded in Section 3, T10N, R43E, approximately 3.5 miles northwest of the project site. The species apparently occurs at this site in sandy soils occupied by a black sagebrush *(Artemisia nova)* community. Kartesz (1988) lists the species as occurring primarily in deep sandy soil with *Rumex, Gilia, Ceanothus, Lupinus,* and *Astragalus.* The plant communities and soils in the proposed permit expansion area are not considered by the BLM to represent likely habitat for the species (Metscher 1994).

The Category 2 species are species of limited distribution and abundance for which a proposed listing as threatened or endangered may be appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support a proposed listing. BLM's management objectives relative to candidate species are to carry out management, consistent with the principles of multiple use, for the conservation of candidate species and their habitats and to ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as threatened or endangered.

The U.S. Fish and Wildlife Service lists five Category 2 candidate species as being potentially present in the project vicinity. These include Eastwood's milkweed (*Asclepias eastwoodiana*), desert whitlowgrass (*Draba arida*), Pahute green gentian (*Frasera pahutensis*), alpine tonestus (*Haplopappus alpinus*), and the sanicle biscuitroot.

The earlier environmental assessments conducted at the mine addressed the possibility of Eastwood's milkweed and Pahute green gentian occurring in the potentially affected areas and included field investigations for suitable habitat. Eastwood's milkweed prefers dry desert washes, and discussions with BLM and Nevada Natural Heritage Program personnel indicated that the nearest known population is more than 10 miles away (Morefield 1994, Biddlecomb 1994b). A review of the habitat preferences listed by Kartesz (1988) for desert whitlowgrass (alpine, talus slopes, rocky crevices and meadows with *Pinus flexilis, Ribes,* and *Chrysothamnus*), Pahute green gentian (gravelly slopes and valley bottoms, with pinyon-juniper to *Artemisia* and *Purshia*), and alpine tonestus (high mountain rocky ridges, crests, and windswept slopes, often above timberline) suggests that these three species would be unlikely in the valley-bottom setting of the proposed project. On-site vegetation surveys within the potentially affected vegetation communities have not detected any of these C2 candidate species (ERT 1987a, Badame 1994).

Nevada statute NRS 527.100 prohibits the destruction or removal of cacti and yucca plants "...without written permission from the legal owner, or his duly authorized agent, specifying locality by legal land description and number of plants to be removed or possessed." The removal and shipment of these species for commercial purposes is regulated under associated statutes. The removal or destruction of the *Opuntia* plants present in the affected area would be subject to written authorization from BLM.

No riparian areas or wetlands occur within the area potentially affected by the proposed action or the alternative tailings impoundment.

3.4.2 Environmental Consequences

Environmental impacts to vegetation were considered significant if the proposed action or selected alternative could result in the following:

- Direct disturbance or a high probability of indirect disturbance of federally threatened or endangered plant species or their critical habitat
- Disturbance of federal candidate species in a manner and a degree that would contribute to their being listed as either threatened or endangered
- Removal or disturbance of unique vegetation communities, e.g., wetlands, that provide outstanding habitat value for wildlife

3.4.2.1 Proposed Action

The proposed action would result in some additional construction activities and disturbance within the current permit boundaries. Portions of this area have already been disturbed by previous activities while other areas have not yet been affected by planned or potential construction. The distribution of the activities associated with the proposed action in relation to disturbed areas and remaining natural vegetation communities in the existing permit area is shown in ***Table 3-19***. ***Table 3-19*** also shows the acreage of each plant

TABLE 3-19
Acreage of Vegetation Communities Affected - Proposed Action

Facility	Shadscale	Greasewood	Fourwing Saltbush	Disturbed	Totals
Within the Existing Permit Area					
Tailings Impoundment	203	25	138	0	366
Collection Ponds	1	2	6	0	9
Pipeline	0	1	0	1	2
Access/Haul Road	0	0	0	1	1
Power Line Spurs	0	4	0	1	5
Mill and Crusher	0	0	0	50	50
Growth Medium Stockpiles	10	42	0	22	74
Total	214	74	144	75	507
Within the Proposed Permit Expansion Area					
Tailings Impoundment	13	0	236	0	249
Collection Ponds	0	0	1	0	1
Total	13	0	237	0	250
TOTAL DISTURBANCE	227	74	381	75	757

community within the proposed permit expansion area that would be directly affected by construction of the various project facilities under the proposed action.

Approximately 757 acres, including areas both within and outside the existing permit boundary, would be affected by the proposed action. Of this total, 682 acres of new disturbance to natural vegetation communities remaining within the existing permit boundary would be disturbed by the proposed action (see ***Table 3-19***). Implementing the proposed action would directly disturb approximately 250 acres of natural vegetation outside the existing permit boundary, including approximately 13 acres of shadscale community and 237 acres of fourwing saltbush community in the area of the proposed tailings impoundment (see ***Table 3-19***). Neither of these communities represents unique vegetation resources in the area. No threatened, endangered, or candidate plant species are likely to be affected by the proposed action. The potential direct impacts to vegetation are not considered significant.

As described in Section 3.6, Range Resources, heavy livestock congregation is expected to continue in the corridor between the mine and State Highway 376, accentuating the existing adverse vegetation impacts as cattle continue to move through the corridor.

Areas affected by the construction of the proposed facilities would be reclaimed following mining according to the SVCO's proposed reclamation plan. The reclamation would include revegetating the tailings impoundment and other disturbed areas with adapted desert grasses, forbs, and shrubs to stabilize soil surfaces and to provide suitable livestock and wildlife forage. While the plant community established by reclamation activities would be self-perpetuating and would include numerous native species, it would be different in species composition from the natural plant communities. Over a period of several decades, it is expected that additional native species from the surrounding undisturbed plant communities would invade the reclaimed areas.

Potential vegetation impacts associated with runoff from the leach offload piles are discussed in Section 3.2.2.1; mitigation for these impacts is identified in Section 3.2.4.

Potential indirect impacts from the proposed activities include the spread of weedy annual species, such as halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola iberica*), which rapidly invade disturbed areas and hinder the establishment of more desirable perennial grasses and forbs by competing with them for moisture during the initial years following disturbance or planting. These potential indirect impacts to

the vegetation resource are not considered significant.

The proposed action would not affect any threatened, endangered, or sensitive plant species.

3.4.2.2 Range Management Alternative

This alternative would result in the same acreage and types of vegetation disturbed by construction as the proposed action. However, the vegetation impacts associated with the grazing use of the narrow corridor between the proposed tailings impoundment and State Highway 376 would be alleviated.

3.4.2.3 Tailings Impoundment Alternative

Table 3-20 shows the acreage of vegetation communities within the existing permit area that would be affected by constructing the tailings impoundment alternative. ***Table 3-20*** shows the acreage of each plant community outside the existing permit boundary that would be affected if the alternative tailings impoundment site were selected for development.

Selection of the alternative tailings impoundment site would result in the additional direct disturbance of approximately 7 acres of shadscale and 2 acres of rabbitbrush within the existing permit area and approximately 439 acres of natural vegetation outside the existing permit area, including approximately 35 acres of the shadscale community and 404 acres of the greasewood community. The disturbance of vegetation for other facilities would be similar to the proposed action. Neither of the communities at the alternative site represents unique vegetation resources in the area. No threatened, endangered, or candidate plant species are likely to be affected by selecting this alternative. The direct vegetation impacts associated with this alternative are not considered significant.

This alternative would result in similar indirect impacts to the proposed action.

3.4.2.4 No Action Alternative

The no action alternative would have no impact on vegetation. No disturbances beyond those presently permitted would occur.

3.4.3 Cumulative Impacts

Reasonably foreseeable future actions in the vicinity of the Round Mountain Mine were examined with respect to cumulative vegetation impacts. These future actions included the SVCO's future dedicated leach pad sites shown in ***Figure 2-10***.

The disturbances associated with the proposed action and reasonably foreseeable future actions at the Round Mountain Mine occur primarily within the shadscale, greasewood, and fourwing saltbush vegetation communities. Total affected acreage in these three communities at the Round Mountain Mine is estimated at approximately 2,000 acres affected by current and past operations, approximately 700 acres potentially affected by the proposed action, and approximately 290 acres potentially affected by reasonably foreseeable expansion activities beyond the proposed action.

TABLE 3-20
Acreage of Vegetation Communities Affected - Tailings Impoundment Alternative

Facility	Shadscale	Greasewood	Rabbitbrush	Disturbed	Totals
Within the Existing Permit Area					
Pipeline	7	0	[illegible]	[illegible]	13
Outside the Existing Permit Area					
Tailings Impoundment	30	386	0	0	416
Collection Ponds	0	10	0	0	10
Pipeline	5	8	0	0	13
Total	35	404	0	0	439
TOTAL DISTURBANCE	42	404	2	4	452

Past mining operations and other disturbances in the vicinity that have affected these same vegetation communities include operations at Gold Hill (approximately 6 miles north of the Round Mountain Mine) and Manhattan (approximately 10 miles to the south). The total area disturbed by historic mining activities at Gold Hill is approximately 342 acres, most of which may have been occupied by a combination of these three vegetation communities. In the Manhattan area, only the lowermost portion of the disturbed area extending along the drainage out into the Smoky Valley would likely have been occupied by any of these communities. Thus, it is estimated that no more than one-quarter of the total disturbed area, or approximately 850 acres, may have originally supported a combination of these communities.

Cumulative disturbance to the three vegetation communities amounts to approximately 4,182 acres in the Big Smoky Valley. Each of the three communities is locally and regionally abundant, and the local occurrences of the communities are not ecologically unique. Thus, it is concluded that the cumulative impacts to these vegetation communities are not significant.

3.4.4 Monitoring and Mitigation Measures

Potential measures to minimize vegetation impacts relate primarily to the design and implementation of the reclamation plan for disturbed areas; the proposed reclamation plan is described in Section 2.3.6, Reclamation. No additional measures are recommended for vegetation.

3.4.5 Residual Adverse Effects

The residual adverse vegetation effects of the proposed action and the tailings impoundment alternative would be determined by the approaches and ultimate success of the reclamation program. Prompt reclamation, resulting in the establishment of stable, productive forage species compatible with the surrounding natural plant communities would minimize residual adverse vegetation effects.

3.5 Wildlife and Fisheries Resources

3.5.1 Affected Environment

3.5.1.1 Wildlife and Fisheries

The project area itself does not contain any key wildlife habitats (Biddlecomb 1994a, Lusk 1994b); however, the project area is on the edge of a yearlong mule deer range. Mule deer occur most frequently to the east of the Round Mountain Mine in higher elevation sagebrush and piñon-juniper habitats (Biddlecomb 1994a, Lusk 1994b). Key mule deer winter ranges occur along the edges of the Toquima and Toiyabe Ranges, well outside of the project area (over 9 miles distant) (Lusk 1994b), although mule deer have been known to use the project area infrequently during winter months. The project area is classified as historic or potential pronghorn habitat, but there are currently no pronghorn in the area (Biddlecomb 1994a). In addition, bighorn sheep occur in the Toquima Range to the northeast (Lusk 1994b), but not in the project area.

Sage grouse are historically known to occur in the area (Lusk 1994b), but there are no known leks in or near the project area itself. The best potential sage grouse habitat is in the sagebrush vegetation east of the project area along the edge of the Toquima Range. Chukar are known to occur along the steeper ridges east of the Round Mountain Mine and could be present in small numbers on the eastern edge of the project area (Lusk 1994b); however, they are most common in the mountain canyons and drainages of this area.

The project area provides limited habitat for waterfowl and waterbirds, and the nearest wetlands of any size are located at Carver Station approximately 6 miles northwest of the project area. Water released from the mine to the rapid infiltration/evaporation basin, which is located approximately 3 miles northwest of the mine, occasionally provides limited habitat for waterfowl and waterbirds.

The proposed project would require an expansion of the existing operation at the Round Mountain Mine. There have been waterfowl deaths associated with the existing operation, primarily caused by entrapment in nets covering the ponds and a smaller number from contact with process solutions and other causes. Any mortalities are reported to the Nevada Division of Wildlife.

Other wildlife in the area includes species characteristic of saltbush, shadscale, and greasewood habitats. Species that have been commonly observed in the project area include the black-tailed jackrabbit, badger, coyote, horned lark, black-throated sparrow, rock wren, kestrel, turkey vulture, raven, prairie falcon (no eyries are present near the mine), sagebrush lizard, short-horned lizard, little pocket mouse, southern grasshopper mouse, Ord's kangaroo rat, deer mouse, and antelope ground squirrel (ERT 1987a, BLM 1992a). There are no known raptor nests in or near the project area (Lusk 1994b). A variety of other mammal, bird, reptile, and amphibian species could potentially occur in the area. A comprehensive list of species potentially occurring in the region is available at the BLM Tonopah Resource Area Office.

The nearest fishery to the project area is Jefferson Creek approximately 2 miles to the northeast. This creek supports a limited freshwater fishery consisting mainly of brook trout (Lusk 1994b). The project area itself does not support any fisheries.

3.5.1.2 Threatened, Endangered, or Sensitive Species

Based on coordination with the U.S. Fish and Wildlife Service pursuant to Section 7(c) of the Endangered Species Act, there are no known federally listed threatened or endangered wildlife species in the project area (ERT 1987a, BLM 1992a, Biddlecomb 1994a, U.S. Fish and Wildlife Service 1994); however, several candidate species (Category 2) have been identified by the U.S. Fish and Wildlife Service as potentially occurring in the area. These species include the spotted bat, pygmy rabbit, loggerhead shrike, ferruginous hawk, white-faced ibis, western snowy plover, and northern goshawk (U.S. Fish and Wildlife Service 1994, Padilla 1995).

The spotted bat generally occurs near water, large trees, and cliffs (Berna 1990, Leonard and Fenton 1983, Wai-Ping and Fenton 1989). The project area does not contain these habitat components and is unlikely to support populations of the

spotted bat. The mountains to the west and east of the project area provide potential habitat for the spotted bat.

The pygmy rabbit occurs most commonly on plains and alluvial fans dominated by big sagebrush, which is the pygmy rabbit's primary source of food (Green and Flinders 1980, White et al. 1982). Other dominant plants in its diet include forbs, wheatgrass, and bluegrass. The dominant vegetation in the project area consists of shadscale, fourwing saltbush, and greasewood, which does not provide good habitat for the pygmy rabbit.

The loggerhead shrike nests in tall shrubs and small trees, which are rare in the project area. It is unlikely that the project area could support nesting shrikes (Brock 1994), although the loggerhead shrike does use the project area for feeding.

The ferruginous hawk is an open grassland and shrubland species that nests on cliffs, on the ground, and in trees. Isolated juniper trees probably provide the best nest sites in the Big Smoky Valley. There are no known nesting ferruginous hawks anywhere near the project area (BLM 1992a, Biddlecomb 1994a, Brock 1994, Lusk 1994b). However, the ferruginous hawk could use the project area for feeding.

The western snowy plover and white-faced ibis have been sighted in the Big Smoky Valley (Padilla 1995). Wetlands near Carver Station (6 miles northwest of the mine) and at the rapid infiltration/evaporation basin (3 miles northwest of the mine) provide potential habitat for these waterbirds. The limited wetland habitat at the rapid infiltration/evaporation basin may attract migrating birds, but the area is unlikely to support nesting birds.

The northern goshawk is a forest-dwelling bird that could occur in the forested mountains east of the project area. It is very unlikely that the goshawk uses the barren shrublands of the project area, and there are no known nesting goshawks anywhere nearby (Biddlecomb 1994a, Brock 1994).

3.5.2 Environmental Consequences

Environmental impacts to wildlife and fisheries resources were considered significant if the proposed action or selected alternative could result in the following:

- Impacts to big game animals (mule deer, pronghorn, or bighorn sheep) if crucial ranges would be developed, resulting in a herd population decline
- Impacts to wildlife habitat if the proposed project were to result in a loss of more than 10 percent of that habitat type in the Big Smoky Valley
- Impacts to sage grouse if active leks were lost because of project development
- Impacts to fisheries resources if dewatering would cause a decline in water flow that reduced the ability of a stream to support a viable population of aquatic organisms
- Impacts to wildlife or migratory birds if the pit lake or tailings impoundment were to cause sufficient acute or chronic toxicity (e.g., increased mortality, reduced growth, or impaired reproduction), resulting in population-level effects (e.g., reduced recruitment, decreased population abundance)
- Impacts to federally listed threatened or endangered wildlife species if the proposed project caused mortality and/or the loss of critical habitat
- Impacts to federal candidate species if the proposed project caused a trend toward listing the species as threatened or endangered

3.5.2.1 Proposed Action

Wildlife. Impacts to wildlife in the proposed project area would result from direct habitat loss and increased human disturbance of wildlife. Project construction would result in the mortality or displacement of an unknown number of small mammals, reptiles, birds, and invertebrates that use these habitats. Adjacent habitats may already be fully occupied by representative small mammals, birds, and reptiles. Thus, it is assumed that displaced animals would be lost from the local population.

Because shadscale, fourwing saltbush, and greasewood habitats are abundant in the Big Smoky Valley (estimated to be 312,000 acres) (BLM 1992a), project construction and operation would not cause regional population level declines for wildlife species associated with these habitats.

Therefore, project construction and operation would not result in significant direct or indirect impacts to wildlife habitat.

As discussed in Section 3.2.2, Water Resources-Environmental Consequences, the area of predicted 10-foot drawdown of ground water in the project area is not anticipated to impact any perennial streams or springs; therefore, no riparian wildlife habitats would be affected.

The project would not cause significant direct or indirect impacts to big game animals because no pronghorn or bighorn sheep use the project area, and mule deer use the project area infrequently (important mule deer range would not be affected). Furthermore, project construction and operation should not affect big game hunting opportunities in the region. However, the increase in personnel associated with project construction and operation could result in increased illegal hunting and the disturbance of mule deer in important habitats east and west of the project area.

In addition, project construction and operation would not cause significant direct or indirect impacts to sage grouse or chukar. The project area does not contain any sage grouse leks or important sage grouse habitat and provides only poor chukar habitat. Project construction and operation should not affect sage grouse and chukar hunting opportunities in the region.

The Migratory Bird Treaty Act was established in 1918 to protect migratory birds (songbirds, waterfowl, raptors, and waterbirds). The act protects migratory birds from take (killing), import, export, transport, purchase, and sale. The U.S. Fish and Wildlife Service is the responsible federal agency for enforcing the act. The Nevada Division of Wildlife is also responsible for enforcing the act. Any mortality of migratory birds caused by poisoning or entrapment in a project facility would be a violation of the Migratory Bird Treaty Act.

Project construction is not expected to cause significant direct or indirect impacts to migratory birds because the project area does not provide important habitat for waterfowl or waterbirds. However, waterfowl and waterbirds are attracted to open water bodies, such as tailings impoundments, during migration periods even though these impoundments provide no food (Lamp 1994). Thus, waterfowl and waterbirds would be expected to land on the proposed tailings impoundment. Residual cyanide in the mill tailings would be neutralized before the material is discharged into the proposed tailings impoundment, and mortality of migratory birds from cyanide would not be expected to occur.

It should be noted that other heavy metals can occur in mine tailings impoundments that could potentially be toxic to wildlife. Toxic elements reported from some tailings include arsenic, mercury, selenium, chromium, copper, and cadmium (Tuttle 1994). Round Mountain tailings samples were analyzed using the Toxicity Characteristic Leaching Procedure and the Meteoric Water Mobility Procedure to determine the toxicity and leachability for potentially hazardous substances in the tailings. Both tests indicated that the concentrations of potentially hazardous substances in the tailings are below concentrations that are considered hazardous by the EPA (Hazen Research, Inc. 1992). Concentrations of potentially toxic substances in the tailings should not pose a threat to wildlife.

Potential wildlife impacts associated with runoff from the leach offload piles are discussed in Section 3.2.2.1; mitigation for these impacts is identified in Section 3.2.4.

Following the cessation of pit dewatering, ground water inflow is predicted to create a surface water body (i.e., a pit lake) that will remain for the foreseeable future (see Section 3.2, Water Resources). The water quality of the pit lake will continue to change from the time the lake begins to form after closure to complete recovery approximately 330 years later and beyond. The final elevation of the pit lake will be approximately 5,528[1] feet, the final pit lake area will be approximately 155 acres (Hydro-Search, Inc. 1994c), and the depth of the pit lake will be approximately 323 feet. See Section 3.2, Water Resources, for a detailed description of the pit lake.

The pit lake water level will rise fairly rapidly until approximately 66 years after mine closure. While some plants and invertebrates will be present at any time after mine closure, it is assumed that after 66 years the water level will

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

be stable enough that vegetated habitat will form along the edge of the pit lake and along the submerged benches at the edge of the lake. The middle portion of the lake will be too deep to support aquatic vegetation. Even though the pit lake will not lie in any important wildlife habitats, the presence of an open water body will attract wildlife. It is assumed that mule deer, bighorn sheep, small mammals, birds, and reptiles could use the pit lake as a drinking water source. Although there are no current nesting areas for waterfowl near the pit lake (Biddlecomb 1995), migrating waterfowl and waterbirds could be attracted to the pit lake; these migrating species could use the lake as a temporary resting area during migration.

Ecological Risk Assessment. An ecological risk assessment was conducted to determine the effects of the pit lake water quality on populations of wildlife that could be attracted to the pit lake and that could use it for drinking water or as nesting habitat. The methodology and results are described in the subsequent paragraphs.

Screening-Level Risk Assessment and Selection of Chemicals of Potential Concern. The water quality of the Round Mountain pit lake was predicted for the period from 9 years to 330 years after the cessation of mining (PTI 1995); ***Table 3-12*** summarizes the predicted chemical concentrations of the pit lake.

Because a large number of chemicals would be present in the pit lake, a screening-level risk assessment was conducted on all chemical constituents included in the pit lake model. The evaluation was based on the highest of the median values predicted for any modeled year within the exposure period. The median concentration predicted for each chemical was compared to drinking water standards for the protection of human health to determine whether a detailed risk assessment for mammals was required. In addition, the median concentration predicted for each chemical was compared to the concentration of the chemical in water that is not expected to cause adverse impacts to mallard ducks. A hazard quotient was calculated by dividing the predicted concentration of the chemical in the pit lake by the screening criterion. If this hazard quotient was greater than 1.0, the chemical was retained for a more detailed risk analysis using a food web model. Because screening criteria are conservative, a hazard quotient that was less than 1.0 indicated no risk to the receptor, and the chemical was not evaluated further.

The screening risk evaluation employed conservative assumptions of exposure and toxicity and was designed to indicate chemicals for which additional risk modeling was required. Drinking water standards are a conservative screening tool for assessing the risks to mammals from drinking pit lake water because the standards are based on the assumption that a 70-kilogram mammal consumes 2 liters of water per day, every day for 70 years. Carcinogens are regulated to a risk level of 1 case of cancer occurring in a population of 100,000 people exposed. Drinking water standards for strontium were not available.

To identify the chemicals of concern for birds, toxicological benchmarks were derived using the specific exposure parameters and the no-observed-adverse-effect level for mallard ducks. The toxicological benchmark values used for breeding mallards are conservative because mallards were assumed to consume 92 percent of their diet from plants and insects in the pit lake as well as their water from the pit lake. Avian toxicity reference values for antimony, chromium(VI), iron, magnesium, manganese, strontium, and thallium were not available for this risk assessment; therefore, the influence of these chemicals on bird populations could not be evaluated.

The results of the screening evaluation (summarized in ***Table 3-21***) indicated that additional toxicity assessment and more detailed modeling of exposure to mammals were required for aluminum, arsenic, fluoride, mercury, nickel, and zinc. The results of the screening evaluation also indicated that additional toxicity assessment and more detailed modeling of exposure to birds were required for mercury, selenium, and zinc. These results triggered an ecological risk assessment, the purpose of which was to evaluate the likelihood of impacts to wildlife from these seven chemicals of potential concern. Although the lack of bioconcentration factors for aluminum and silver uptake by aquatic plants precluded their evaluation in the mallard screening-level assessment, risks to killdeer and cliff swallow from ingesting insects containing these chemicals were evaluated in the food web modeling assessment.

TABLE 3-21
Results of the Screening Evaluation

Analyte	Maximum Hazard Quotient	
	Mammal[1]	Waterfowl[2]
Alkalinity	NA	NA
Aluminum	9.8	--
Antimony	<1	--
Arsenic	1.1	<1
Cadmium	<1	--
Calcium	NA	NA
Carbonate	NA	NA
Chloride	<1	NA
Chromium(III)	<1	--
Chromium(VI)	<1	--
Copper	<1	<1
Fluoride	17	--
Hydrogen ion	NA	NA
Iron(II)	<1	--
Iron(III)	--	--
Lead	<1	<1
Magnesium	NA	NA
Manganese	<1	--
Mercury	1.1	1.6
Nickel	1.2	--
pH	NA	NA
Potassium	NA	NA
Selenium	<1	3.7
Silver	<1	--
Sodium	NA	NA
Strontium	--	--
Sulfate	NA	NA
Thallium	<1	--
Total dissolved solids	NA	NA
Zinc	1.3	180

-- = Data gap. Analyte could not be screened in the risk assessment.
NA = Not analyzed. Analyte not expected to affect wildlife.
[1] Hazard quotients calculated by dividing the maximum predicted concentration of the chemical by the human health drinking water standard.
[2] Hazard quotient calculated by dividing the maximum predicted concentration of the chemical by the toxicological benchmark for mallards. Benchmarks were derived from no-observed-adverse-effect levels.

Selection of Wildlife Receptor Species and Exposure Pathways. Ecological risk was analyzed for six receptor species: killdeer, cliff swallow, mallard, golden eagle, mule deer, and bighorn sheep. These species were selected because they represent a range of animal types that may use the Round Mountain pit lake and a range of exposure scenarios (ways that an animal may be exposed to a chemical).

The ecological risk assessment was used to estimate risk to these species based on predicted chemical concentrations in the pit lake at two time periods: 0 to 159 years after mine closure and 160 to 330 years after mine closure. While plants and insects may inhabit the pit lake at any point after mine closure, it was assumed that aquatic vegetation and an associated ecosystem sufficient for bird habitat would form along the edges of the

pit lake beginning approximately 66 years after mine closure.

Ingestion of water, food (plants and insects), and sediment were included in the exposure analysis for both time periods for killdeer, cliff swallow, and mallard. Exposure to chemicals through ingestion of water was analyzed for both time periods for golden eagle, mule deer, and bighorn sheep. ***Table 3-22*** summarizes the exposure pathways evaluated.

Assumptions and Uncertainties. The ecological risk assessment was based on assumptions relative to the water quality modeling, the habitat conditions of the pit lake and associated wildlife use, sediment concentrations, bioconcentration factors, and chemical toxicity. These assumptions are summarized below.

- Pit Lake Water Quality - It should be noted that confidence in the predicted water quality decreases with increasing time due to uncertainty in the long-term stability of meteorologic conditions, ground water flow rates, and ground water chemistry. Therefore, the predicted water quality is considered the best estimate of future water quality assuming that the current climatic and ground water conditions in the future are similar to existing conditions. Based on the water quality modeling results, aluminum, arsenic, magnesium, nickel, zinc, mercury, selenium, and fluoride concentrations are predicted to increase over time (PTI 1995). Eventually, the concentration of total dissolved solids is anticipated to increase to a point where the pit lake water is no longer palatable for wildlife consumption or the aquatic ecosystem cannot sustain sufficient food resources for wildlife; the time period to reach this condition is unknown.

  The major parameters affecting the pit lake water quality are regional ground water quality, pyrite oxidation and acid generation in the pit walls, leaching of metals from the wall rock, chemical reactions in the lake, and long-term evaporative concentration. The method used to predict the pit lake water quality is described by PTI (1995).

- Pit Lake Habitat and Wildlife Use - It is assumed that as the pit lake approaches hydraulic equilibrium, aquatic plant and invertebrate communities would establish around the pit lake perimeter in a shallow water zone approximately 9 acres in area (PTI 1995a). The risk assessment was based on specific assumptions regarding the percentages of water and diet the pit lake would provide for each receptor species; see PTI (1995a).

- Actual wildlife use of the pit lake will depend on the quality of the aquatic ecosystem that develops and many other factors. The steep sides, lack of extensive surrounding wetland vegetation, and lack of islands may prevent the pit lake from becoming important habitat for nesting waterfowl; however, the lake is likely to attract migrating waterfowl and other waterbirds. The pit will be surrounded by a 10-foot chain link/barbed wire security fence and a 5-to-8 foot rock berm to preclude the access of most local mule deer and bighorn sheep to the pit lake. It is assumed that humans will not gain access to the pit lake to introduce fish, and there will be no surface inflows to the pit lake; therefore, no fish will be present in the pit lake. Fish were not included as a potential food source for receptors in the risk assessment.

- Sediment Concentrations - To estimate bird exposure to aluminum, mercury, selenium, silver, and zinc through ingestion of sediments, concentrations of these metals in sediments had to be estimated. Sediment in the pit lake would consist of (1) wind-blown dust, (2) material eroded from wall rock, (3) precipitating chemicals from the pit lake water, and (4) organic detritus settling from the water column. The estimated concentrations of selected metals in sediment derived from wall rock, chemical precipitates, and organic detritus are presented in ***Table 3-23***. The actual concentrations of metals in the lake sediment would depend on the metals concentrations in the various materials contributing to the sediment, the degree to which these materials mix, and their deposit rates.

  The total deposition rate for sediment derived from dust is estimated to be small, on the order of 0.01 millimeter per year; the chemical concentrations in sediment derived from dust are anticipated to be less than or equal to the concentrations in the average wall rock. The sediment deposition rate from wall rock and pit bench erosion could not be estimated with the available data but is anticipated to be significant. The rate of deposition of and the concentration

TABLE 3-22
Exposure Routes for the 160- to-330-Year Modeling Period[1]

Receptor	Ingestion of Water	Ingestion of Aquatic Vegetation	Ingestion of Aquatic Invertebrates	Ingestion of Sediment
Killdeer	X		X	X
Cliff Swallow	X		X	X
Mallard	X	X	X	X
Golden Eagle	X			
Mule Deer	X			
Bighorn Sheep	X			

[1] These exposure routes apply to both the screening-level assessment and the food web exposure model. Exposure to chemicals via ingestion of sediment was considered only by the food web exposure model.
Source: PTI 1995a

TABLE 3-23
Estimated Concentrations of Chemicals of Concern in Various Components of Pit Lake Sediments (all units milligrams/kilogram)

Estimated Sedimentation Rate	Average Wall Rock ND	Chemical Precipitates 0.2 mm/yr	Organic Detritus 1 mm/yr	Sediment Derived from Water Column Constituents[1,2] 1.2 mm/yr
Aluminum	7,731	568	NA	NA
Mercury	0.05	0.017	0.021	0.020
Silver	3.35	0	NA	NA
Selenium	0.53	<0.001	0.11	0.090
Zinc	48.7	158	49.3	69.27

NA = Partitioning relations for these chemicals to zooplankton are not available.
ND = Not determined.
mg/kg = milligrams per kilogram
mm/yr = millimeters per year
[1] Sediment is composed of chemical precipitates plus organic detritus.
[2] Estimated chemical precipitate deposition rate of 180 grams per square meter per year and organic detritus deposition rate of 800 grams per square meter per year.

of metals from the chemical precipitates were based on results from the pit lake water quality model. The estimated deposition rate for the chemical precipitates along the margin of the lake (average water depth of 8 feet) is 0.2 millimeter per year. Estimates of plankton concentrations, bioaccumulation of metals, and plankton mortality rates were used to estimate the mass and metals concentrations of sediments accumulated from organic detritus. The estimated deposition rate for organic detritus is 1 millimeter per year. The estimated mercury, selenium, and zinc concentrations in the chemical precipitates and the organic detritus were combined to calculate the mercury, selenium, and zinc concentrations in sediment derived from the water column. As shown in ***Table 3-23***, the estimated concentrations of mercury and selenium in sediment derived from the lake column are less than for sediment derived from the average wall rock composition, whereas the zinc concentrations are roughly comparable in these two media. Since the actual ratio of sediment derived from the wall rock versus sediment derived from the lake water column is unknown, the composition of the lake sediment was assumed to equal the average wall rock composition.

- Bioconcentration Factors - ***Table 3-24*** provides bioconcentration factors used in both the screening evaluation and the risk assessment

TABLE 3-24
Bioconcentration Factors Used to Estimate Chemical Concentrations in Aquatic Foods of Wildlife Species

	Bioconcentration Factor (L/kg)		
	Plant	Insect	Source
Aluminum	NA	197	Frick and Herrmann (1990)
Arsenic	215	9	Lee et al. (1991), U.S. EPA (1980)
Copper	18.7	970	Singha and Chandra (1990), Nehring (1976)
Lead	165	1,000	Fayed and Abd-El-Shafy (1985), Nehring (1976)
Mercury	281	380[2]	Coquery and Welbourn (1994), Saouter et al. (1993)
Selenium	89	434	Schuler et al. (1990)
Silver	NA	27	Nehring (1976)
Zinc	3,674	710	Fayed and Abd-El-Shafy (1985), Nehring (1976)

NA = Not available
L/kg = Liters per kilogram
[1] The bioconcentration factor for total mercury.
[2] The bioconcentration factor for methylmercury.
Source: PTI (1995a)

for birds. These bioconcentration factors were multiplied by concentrations of the chemicals in water to estimate the concentration of chemicals of potential concern in food sources (plants or invertebrates) consumed by birds. Bioconcentration factors vary greatly depending on the organism, geographic location, chemical form, and water chemistry. For some chemicals, a range of bioconcentration factors may be found in the literature. The bioconcentration factors used in the risk assessment were selected because they were derived from sound scientific studies, and the test conditions were as similar as possible to the predicted pit lake conditions (PTI 1995a). One bioconcentration factor was selected for plants and one for invertebrates to estimate dietary intake of a chemical for each receptor species; it was not possible to determine an individual bioconcentration factor for each plant or invertebrate species that might be consumed.

- Gastrointestinal Absorption Efficiency - The absorption efficiency of chemicals from aquatic organisms used as food by receptors may be less than the absorption efficiency of soluble chemicals spiked into laboratory foods and used in toxicity tests (ATSDR 1994, Pascoe et al. 1994; see discussion in PTI 1995a). For the food web model, the absorption efficiency of each chemical in food and sediment from the pit lake was assumed to be one-half (0.5) the absorption efficiency of that chemical from laboratory media. The relative absorption efficiency of water was assumed to be 1.0 (PTI 1995a).

- Chemical Toxicity - Toxicity reference values were determined by extrapolating laboratory data from animal test species (e.g., laboratory mice) to receptor species (e.g., mule deer); this approach is standard practice for risk assessments because of a lack of specific toxicity data for most of the receptor species.

- Chemicals were considered individually in this risk assessment. Additive, antagonistic, and synergistic effects were not evaluated because these effects are difficult to apply quantitatively with accuracy in ecological risk assessments.

Data Gaps. It is not possible to calculate the intake of cadmium, chromium, fluoride, and nickel by mallards, killdeer, and cliff swallows feeding in the pit lake in the absence of bioconcentration factors for these chemicals. Water-to-insect bioconcentration factors for aluminum and silver were available and were used to calculate intake of these metals by killdeer and cliff swallows. Water-to-plant bioconcentration factors for aluminum and silver were not available, so exposure of mallards to these metals could not be estimated. Drinking water standards are not available (or are not health-based) for alkalinity, calcium, carbonate, hydrogen ions, iron(III), pH, potassium, sodium, or strontium. With the exception of strontium, these

chemicals are not expected to affect the health of aquatic species or wildlife. The influence of strontium on mammals could not be evaluated. Avian toxicity reference values for antimony, chromium(VI), iron, manganese, strontium, and thallium were also not available for this risk assessment. The influence of these chemicals on bird populations could not be evaluated (PTI 1995a).

Food-Web Modeling Analysis. If the hazard quotient based on the screening criteria equals or exceeds 1.0, the typical procedure is to advance to the next tier of risk evaluation: a baseline ecological risk assessment. In a baseline ecological risk assessment, tissue samples may be collected from appropriate media in the area of concern to remove uncertainties associated with using bioconcentration factors. Further, in the baseline ecological risk assessment, assumptions of wildlife use of the habitats are refined to more accurately reflect actual use and how species become exposed to chemicals. This procedure results in a more accurate evaluation of exposure and risk.

However, in the case of the Round Mountain pit lake, it is not possible to advance the risk evaluation procedure to a baseline ecological risk assessment. Because the pit lake has not yet developed, chemical concentrations in water, sediment, or organisms cannot be determined empirically. The purpose of the screening-level ecological risk assessment was to identify which chemicals require further risk evaluation; the food web modeling analysis was conducted to more accurately evaluate the risk to wildlife within the context of these limitations. Assumptions regarding wildlife use of habitats were adjusted to more realistically model how wildlife might use the pit lake and become exposed to lake chemicals.

Exposure of mammals to aluminum, arsenic, fluoride, mercury, nickel, and zinc and exposure of birds to mercury, selenium, and zinc were evaluated using a food web modeling approach. Exposure of cliff swallows and killdeer to aluminum and silver was also estimated using the food web model (exposure of mallards to these metals could not be estimated because water-to-plant bio-concentration factors for these metals were not available). This approach provided an estimate of chemical uptake by receptors through ingestion of lake water, aquatic vegetation and invertebrates, and sediment (see ***Table 3-22***), and incorporated species-specific assumptions concerning use of the pit lake (e.g., the percentage of water or diet needs that may be satisfied for each receptor species by the pit lake).

The estimated daily ingestion rate of the chemical for each receptor was compared to the no-observed-adverse-effect level of the chemical for that receptor using a hazard quotient. In some instances, a no-observed-adverse-effect level value was not available because the toxicity study from which the toxicological benchmark is derived calculated only a lowest-observed-adverse-effect level value (i.e., all the dosages used in the test produced some level of effect in the test organisms). In such instances, a no-observed-adverse-effect level toxicological benchmark was conservatively estimated by applying an uncertainty factor of 10 to the lowest-observed-adverse-effect level.

If a hazard quotient based on a no-observed-adverse-effect level was equal to or exceeded a value of 1.0, the risk was further evaluated by recalculating the hazard quotient using the lowest-observed-adverse-effect level, consistent with EPA guidance. The lowest-observed-adverse-effect level represents the lowest rate of chemical intake by wildlife known to produce adverse effects. Exceedance of the lowest-observed-adverse-effect level indicates that exposure of the receptor to the chemical is greater than exposure that causes effects in laboratory animals. The final step in the risk evaluation procedure was to interpret each hazard quotient equaling or exceeding a value of 1.0 based on a lowest-observed-adverse-effect level in the context of the various model assumptions and uncertainties.

Criteria for interpreting hazard quotients are identified in ***Table 3-25***.

TABLE 3-25
Interpretation of Hazard Quotients

Hazard Quotient	Interpretation
<1	A hazard quotient based on the wildlife lowest-observed-adverse-effect level less than 1.0 indicates a very low probability of individual or population-level effects.
1-10	A hazard quotient based on the wildlife lowest-observed-adverse-effect level between 1.0 and 10 indicates that effects to some individuals may occur, but population-level effects are unlikely. Risk should be further evaluated in the context of the assessment's assumptions and uncertainties.
>10	A hazard quotient based on the wildlife lowest-observed-adverse-effect level greater than 10 indicates that a population-level effect is likely.

Source: PTI 1995a.

The results of the food web modeling analysis are presented in ***Table 3-26***. The analysis indicates that during the 0-to-159-year modeling period the predicted concentrations of all chemicals except zinc are below levels that would pose a significant risk to wildlife populations. The population is defined as those receptors and their offspring that use the pit lake. For the 160-to-330-year modeling period, the hazard quotients based on the lowest-observed-adverse-effect level were less than 1.0 for all receptor species and chemicals of potential concern except the zinc hazard quotient for mallards. While the zinc hazard quotients for killdeer and cliff swallow derived from the no-observed-adverse-effect-level for those species are slightly greater than 1.0, the zinc hazard quotients derived from the lowest-observed-adverse-effect-level are less than 1.0, indicating no significant risk from zinc to these receptor species. Similarly, the selenium hazard quotient derived from the no-observed-adverse-effect-level for mallards is 1.9, but the hazard quotient derived from the lowest-observed-adverse-effect-level is less than 1.0, indicating no significant risk to mallards from exposure to selenium.

As indicated above, the antimony, chromium, iron, fluoride, manganese, nickel, silver, strontium, and thallium hazard quotients could not be determined for all receptors because of key data gaps in the literature. Killdeer, cliff swallows, and mallards may be exposed to these chemicals by ingesting food organisms from the pit lake, but risk to these species could not be predicted because of the data gaps. The results of the risk assessment and the assumptions used in the model are summarized below for each receptor species (PTI 1995a).

Killdeer. The killdeer represents bird species that could use the pit lake shoreline habitat for nesting and feeding. A killdeer would be expected to obtain some of its food and all of its water from the lake. Comparison of predicted chemical concentrations to toxicity reference values in the wildlife risk assessment model indicate that there is a low risk of reproductive effects to individual killdeer (shorebirds) and to populations expected to use the pit lake. Although killdeer may be exposed to antimony, chromium, iron, fluoride, magnesium, nickel, strontium, and thallium by ingesting food organisms from the lake, risk to killdeer from these chemicals could not be estimated because of data gaps.

Cliff Swallow. The cliff swallow represents small insectivorous passerine birds that would obtain all of their food and water from the pit lake. The diet of the cliff swallow consists entirely of invertebrates that would emerge from the lake. The results of the comparison of predicted chemical concentrations to toxicity reference values in the wildlife risk assessment model indicate that there is a low risk of reproductive effects to individual cliff swallows and to populations expected to use the pit lake. Although cliff swallows may be exposed to antimony, chromium, iron, fluoride, magnesium, nickel, strontium, and thallium by ingesting food organisms from the lake, risk to cliff swallows from these chemicals could not be estimated because of data gaps.

Mallard. The mallard represents dabbling ducks that would obtain most (more than 90 percent) of their food and all of their water from the pit lake. The mallard represents any species of waterfowl that would consume aquatic invertebrates and plants from the lake in roughly equal proportions. Comparison of predicted chemical concentrations to benchmark values and the results of wildlife risk assessment model indicate that there is no significant risk of reproductive effects to individual mallards or to populations of mallards from exposure to arsenic, cadmium, copper, lead, mercury, and selenium. Although mallards may be

TABLE 3-26
Results of the Food Web Model Risk Characterization

	Hazard Quotient[1]			
	0-159 Year Exposure Scenario		160-330 Year Exposure Scenario	
	Water Ingestion	Multimedia Ingestion[2]	Water Ingestion	Multimedia Ingestion[3]
Killdeer				
Aluminum	<0.01	0.13	<0.01	0.13
Mercury	<0.01	0.06	<0.01	0.08
Selenium	<0.01	0.10	<0.01	0.17
Silver	<0.01	0.02	<0.01	0.03
Zinc	0.01	0.93	0.01	1.8 (0.18)[4]
Cliff swallow				
Aluminum	<0.01	0.13	<0.01	0.14
Mercury	<0.01	0.04	<0.01	0.06
Selenium	<0.01	0.08	<0.01	0.13
Silver	<0.01	0.02	<0.01	0.03
Zinc	0.01	0.74	0.01	1.4 (0.14)[4]
Mallard				
Mercury	<0.01	0.46	<0.01	0.78
Selenium	<0.01	1.0 (0.5)[4]	<0.01	1.9 (0.95)[4]
Zinc	0.01	46 (4.6)[4]	0.01	90 (9.0)[4]
Revised zinc[5]	<0.01	12 (1.2)[4]	<0.01	24 (2.4)[4]
Golden eagle				
Mercury	<0.01	NA	<0.01	NA
Selenium	<0.01	NA	<0.01	NA
Zinc	<0.01	NA	<0.01	NA
Mule deer				
Aluminum	0.04	NA	0.05	NA
Arsenic	0.01	NA	<0.01	NA
Fluoride	0.04	NA	0.07	NA
Mercury	<0.01	NA	<0.01	NA
Nickel	<0.01	NA	<0.01	NA
Zinc	<0.01	NA	<0.01	N
Bighorn sheep				
Aluminum	0.04	NA	0.06	NA
Arsenic	<0.01	NA	<0.01	NA
Fluoride	0.04	NA	0.08	NA
Mercury	<0.01	NA	<0.01	NA
Nickel	<0.01	NA	<0.01	NA
Zinc	<0.01	NA	<0.01	NA

NA =Not applicable
U= Unknown (data gap)
[1] Hazard quotient is based on wildlife no-observed-adverse-effect-level except as noted (see footnote 4).
[2] Food and water.
[3] Food, water, and sediment.
[4] Hazard quotient in parentheses is based on wildlife lowest-observed-adverse-effect-level.
[5] Zinc concentration in water was recalculated after removing one anomalistically high value that appeared to have been elevated due to the presence of zinc in drilling materials. Risks were recalculated using the revised estimate for zinc. See text for discussion.
Source: PTI 1995a

exposed to aluminum, antimony, chromium, iron, fluoride, magnesium, nickel, silver, strontium, and thallium by ingesting food organisms from the lake, risk to mallards from these chemicals could not be estimated because of data gaps.

Consistent with the criteria for interpretation of hazard quotients (***Table 3-25***), factors affecting the zinc hazard quotient for mallards were evaluated in an uncertainty analysis. Additional evaluation of the estimated concentration of zinc in the pit lake and the water-to-plant bioconcentration factor was conducted to provide a range of uncertainty associated with the zinc hazard quotient for mallards.

In the 0-to-159-year exposure scenario, mallards nesting at the pit lake could ingest an average daily dose of 4.6 times the lowest observed dose of zinc that causes mortality in laboratory birds. In the 160-to-330-year exposure scenario, mallards could ingest an average daily dose of zinc that is 9.0 times the lowest observed dose that causes mortality in laboratory birds. The hazard quotients are presented in ***Table 3-26***.

As discussed in Section 3.2.2, the relatively high zinc concentrations predicted are strongly influenced by one apparently anomalous concentration reported from an initial sample collected from well DMW-3. On the basis of later samples collected from this well and other recent samples from other wells within the same geologic unit, it appears that the initial data point may have resulted from sample contamination. If that datum is removed, and the zinc concentrations are recalculated, the hazard quotient using the lowest-observed-adverse-effect level for mallards is 1.2 for the 0-to-159-year period, and 2.4 for the 160-to-330-year period. In addition, the zinc hazard quotients in ***Table 3-26*** are based on a bioconcentration factor of zinc by plants of 3,674 liters per kilogram. Based on a review of available studies evaluating the bioconcentration of zinc by plants (PTI 1995a), the bioconcentration factors ranged from 10 to 4,875 liters per kilogram. Using the median water-to-plant bioconcentration factor for zinc (440 liters per kilogram) and the revised estimate of the zinc concentration in water, the zinc hazard quotient in the 0-to-159-year period is 0.35 and in the 160-to-330-year period is 0.69. This analysis suggests that the zinc hazard quotients for mallards reported in ***Table 3-26*** may overstate the risk to this receptor and indicates the range of uncertainty associated with the risk estimate.

It is necessary to interpret the results of the food web model for mallards in the context of the uncertainties of the risk model. The assumption that sufficient habitat will be available to support nesting mallards in the 0-to-159-year period is conservative. It is not known whether or when the extent of habitat will be sufficient to support breeding dabbling ducks, and the number of ducks that will be able to occupy the area is unknown. Therefore, a quantitative estimate of population impacts is not possible.

In light of uncertainties, the zinc hazard quotient for mallards suggests that there may be impacts to individuals as a result of exposure to chemicals in the pit lake based on the results of the ecological risk assessment, but population-level impacts are unlikely.

Golden Eagles. The golden eagle represents a large bird of prey that may use the lake for some drinking water but would obtain none of its food from the pit lake. It is assumed that the eagle would consume only a fraction (20 percent) of its daily water requirement from the pit lake. The results of the comparison of predicted chemical concentrations to benchmark values and of the wildlife risk assessment model indicate that there is negligible risk of reproductive effects to individual eagles (raptors that do not obtain any of their food from the lake) and to populations expected to use the pit lake.

Mule Deer. The mule deer represents a large ungulate mammal that would obtain 25 percent of its drinking water from the pit lake but none of its food from the pit lake. The results of the comparison of predicted chemical concentrations to benchmark values and of the wildlife risk assessment model indicate that there is negligible risk of reproductive effects to individual mule deer and to populations expected to use the pit lake.

Bighorn Sheep. The bighorn sheep represents a large ungulate mammal that would obtain 25 percent of its drinking water from the pit lake but none of its food from the pit lake. The results of the comparison of predicted chemical concentrations to benchmark values and of the wildlife risk assessment model indicate that there is negligible risk of reproductive effects to individual bighorn

sheep and to populations expected to use the pit lake.

Fisheries. The only fishery that occurs near the proposed project is in Jefferson Creek to the northeast of the project area. This creek is perennial only in the Toquima Range, which is above the elevation of the pit rim; when the creek reaches the valley floor, it becomes ephemeral. The project is unlikely to cause significant impacts to fisheries resources in Jefferson Creek in the Toquima Range.

Threatened, Endangered, or Sensitive Species. The project would not have significant direct or indirect impacts on any federally listed or candidate species because the area does not provide habitat for these species. The ferruginous hawk and loggerhead shrike could use the project area for feeding, and project construction and operation would remove a small amount of potential feeding habitat for these species. The white-faced ibis and western snowy plover could use wetlands within 3 miles of the project area. These species may also be attracted to the tailings impoundment and pit lake. It is unlikely that the tailings impoundment and pit lake would provide important feeding or nesting habitat for these species. However, the presence of large water bodies may attract these birds during migration periods. As discussed previously, chemicals in the tailings impoundment would be at concentrations below toxic levels. The ecological risk assessment included an analysis of pit lake impacts to the killdeer, and the results indicated that the pit lake presented a low risk of reproductive effects to the killdeer. The white-faced ibis and western snowy plover use food and habitats similar to those preferred by the killdeer. However, the ibis and plover are much more rare in the area, and impacts to these species from the pit lake would be minimal. The spotted bat, pygmy rabbit, and northern goshawk are not likely to occur in the project area, and no impacts to these species would be expected to occur from project construction or operation.

3.5.2.2 Range Management Alternative

Eliminating grazing from this area would benefit wildlife by allowing more growth of forbs and grasses. This alternative would not result in significant impacts to wildlife or fisheries resources.

3.5.2.3 Tailings Impoundment Alternative

The wildlife impacts associated with the alternative tailings impoundment would be similar to the proposed action. The primary habitat affected by this alternative would be greasewood instead of fourwing saltbush.

The alternative tailings impoundment area does not contain any important habitat for big game, sage grouse, chukar, migratory birds, fisheries, threatened or endangered species, or candidate species. Furthermore, all tailings would be neutralized to prevent wildlife exposure to cyanide toxicity. Construction and operation of this alternative would not result in significant impacts to wildlife or fisheries resources or their habitats.

3.5.2.4 No Action Alternative

The potential wildlife impacts associated with the construction and operation of the proposed mill and tailings impoundment would not occur under the no action alternative. The current permitted activities at the Round Mountain Mine would continue, including mining the open pit. Therefore, the pit water quality impacts to wildlife would be the same as the proposed action.

3.5.3 Cumulative Impacts

The cumulative impact area comprises the Big Smoky Valley from the Gold Hill Mine to the Manhattan Mine. Currently, there are approximately 4,767 acres of mainly fourwing saltbush, shadscale, and greasewood habitats permitted for mine use. The proposed action would expand the mine permit area by an additional 250 acres consisting of shadscale and fourwing saltbush habitats. This would produce a total of approximately 5,017 acres of potential long-term (more than 10 years) habitat loss associated with the mining operation. Compared to the estimated total acreage of these habitat types in the Big Smoky Valley (312,000 acres) (BLM 1992a), the loss is considered minor. The cumulative loss of this habitat would be expected to cause localized population declines (in the immediate project area) for small mammals, birds, reptiles, and invertebrates associated with these shrubland habitats. On a regional level and in the cumulative impact area, these habitat and population losses are not considered significant. Cumulative impacts to big game, sage grouse, chukar, migratory birds,

threatened or endangered species, and federal candidate species associated with habitat loss would be minimal.

There is the potential for various facilities at the Round Mountain Mine site to have cumulative impacts on waterfowl and waterbirds. As indicated in the descriptions of the existing and proposed operations, the processing ponds are netted and the tailings material would be neutralized prior to disposal to mitigate wildlife impacts. Future processing facilities at the Round Mountain Mine would be constructed and operated in a similar manner. Therefore, the potential for cumulative adverse water quality impacts to wildlife, particularly waterfowl and waterbirds, from these facilities is considered small.

The Round Mountain pit lake could attract migrating waterfowl and waterbirds and may provide some nesting habitat for waterfowl and waterbirds. The pit will be fenced and bermed to preclude the use of the pit lake as a water source for most local mule deer, bighorn sheep, and other wildlife. Based on the results of the ecological risk assessment, the Round Mountain pit lake may cause long-term impacts to individual waterfowl, but population-level impacts are unlikely.

The Manhattan Mine West Pit lake, located approximately 15 miles south of the Round Mountain site, is approximately 20 to 30 acres in size. The existing and equilibrium pit lake water quality is anticipated to meet Nevada primary drinking water standards with the exception of total dissolved solids, sulfate, magnesium, and manganese (Hydro-Search, Inc. 1994d). Water quality data indicate no potential toxicity problems from the Manhattan pit lake to wildlife. No past, present, or reasonably foreseeable future projects are anticipated to result in cumulative impacts together with the Round Mountain pit lake.

3.5.4 Monitoring and Mitigation Measures

As part of the proposed action, all power lines would be constructed according to BLM guidelines to prevent raptors from being electrocuted. In addition, all materials deposited into the tailings impoundment would be neutralized to prevent cyanide toxicity to wildlife. The material added to the tailings impoundment would be periodically tested to determine if toxic levels of arsenic, lead, mercury, cadmium, selenium, and other elements are present. If toxic levels of other elements are present, they would be neutralized before being added to the tailings impoundment.

Migratory birds are protected by the Migratory Bird Treaty Act. To prevent any violation of this act, the tailings would be neutralized to prevent cyanide toxicity to waterfowl. The tailings impoundment would be monitored for dead or dying waterfowl; any dead birds would be reported to the Nevada Division of Wildlife and handled as instructed.

As part of the proposed action, the tailings impoundment and mill site would be recontoured and revegetated at closure with a diverse mixture of grasses, forbs, and shrubs. Successful revegetation would largely mitigate temporary losses of cover and food sources caused by construction and operation. Revegetation techniques would follow guidelines in the Reclamation Plan (RMGC 1995). The tailings impoundment surface would be reconfigured to be a non-impounding structure, and a layer of suitable plant growth media would be placed over the tailings material. The topography would be varied to the extent possible to enhance wildlife habitat, and rock piles and raptor perches would be incorporated into the site reclamation. Associated process ponds would be backfilled and revegetated. These proposed practices, combined with the low amount and frequency of precipitation and high evaporation rates typical of the site, would mitigate the potential for standing water to attract waterfowl in the long-term, postmining phase of the project.

The SVCO will monitor pit lake water quality during mine reclamation and closure (approximately 2 years). The Nevada Division of Environmental Protection will require postclosure monitoring, as described in Section 3.2.4.

3.5.5 Residual Adverse Effects

Residual adverse effects would include the loss of shadscale and fourwing saltbush vegetation and the associated wildlife habitat; increased regional human use, resulting in increased illegal hunting; increased disturbance of wildlife; and potential toxicological impacts to waterfowl associated with pit water quality.

3.6 Range Resources

3.6.1 Affected Environment

The Round Mountain Mine is bordered on the north, west, and south by BLM lands used for livestock grazing. Implementation of the proposed action would expand the mine permit area, thus removing some of the area currently being grazed, and may affect grazing management of additional areas through changes in access or water supply.

The proposed expansion and the majority of the existing operations occur within the southern portion of the Smoky Grazing Allotment. This BLM allotment encompasses approximately 126,976 acres and extends from a southern boundary approximately 5.5 miles south of the intersection of State Highways 378 and 376 to a northern boundary approximately 20.5 miles north of this point. The allotment is approximately 14 miles wide at its widest point near the north end and diminishes in width toward its southern end, being only approximately 2.5 to 3 miles wide near the Round Mountain Mine (***Figure 3-24***). This allotment is adjoined on the north by the BLM Wildcat Allotment, on the east by the Toiyabe National Forest, on the south by the BLM San Antone Allotment, on the southwest by the BLM Francisco Allotment, and on the west by the Toiyabe National Forest.

Two local livestock operations hold grazing permits on the Smoky Allotment, for a total of 5,598 animal unit months. An animal unit month represents the quantity of forage necessary to sustain a cow and calf for 1 month. ***Table 3-27*** provides the breakdown of permitted uses among these permittees. Current permitted use on the allotment totals 4,939 animal unit months with 650 animal unit months of nonuse by RO Livestock. An additional 226 animal unit months of permitted use by the Russell Berg Ranch were suspended in 1989.

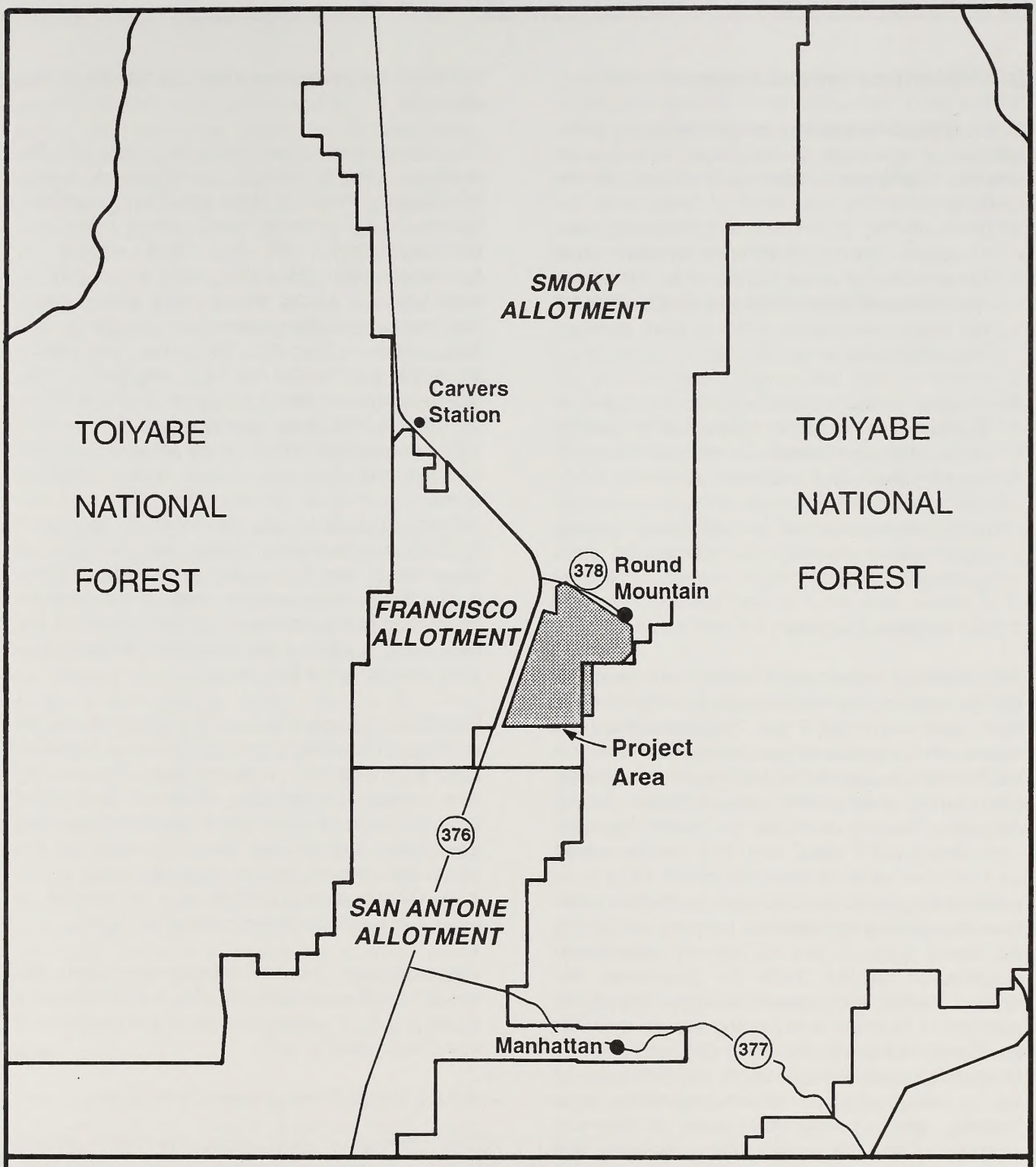
Water sources for livestock in the southern portion of the allotment near the Round Mountain Mine include the mine dewatering discharge across portions of Sections 23 and 24, T10N, R43E along the north side of the mine access road; a water tank in Section 10, T9N, R43E to which water is hauled by RO Livestock during its period of grazing use; and a well in Section 24, T11N, R43E. Some springs exist a short distance east of the allotment on the Toiyabe National Forest, and a few of the mountain drainages (e.g., Jefferson Creek) occasionally flow far enough in the spring of wet years to provide water for livestock on the allotment.

Discussions with mine personnel and the grazing permittees indicate that existing conflicts between mining operations and grazing on the allotment are negligible. Although the mining operations have taken up acreage previously available for grazing, this impact has been offset by the convenience of the watering source provided by the mine dewatering channel flowing westerly from the north end of the mining operation. Livestock mortality caused by traffic accidents has not been significant.

Easy access to the mine dewatering stream in Sections 23 and 24, T10N, R43E has contributed to heavy congregation of livestock in the area immediately west of the mine, including the entire corridor between the mine and State Highway 376. As a result, this area has been seriously overgrazed, vegetation is in a reduced seral stage, and increased soil erosion is evident.

TABLE 3-27
Smoky Allotment Grazing Permits

Permittee	Livestock		Grazing Period		Type of Use	AUMs
	Kind	Number	Begin	End		
RO Livestock	Cattle	506	3/1	6/30	Active	2,030
		81	3/1	6/30	Nonuse	325
		506	11/1	2/28	Active	1,996
		81	11/1	2/28	Nonuse	325
Russell Berg Ranch	Cattle	77	3/1	2/28	Active	927



Source: BLM, Map 20,
Tonopah Resource Management Plan, Tonopah East

Round Mountain Mine

Figure 3-24
BLM Grazing Allotments

3.6.2 Environmental Consequences

Environmental impacts to range resources were considered significant if the proposed action or selected alternative could result in any of the following:

- Excessive grazing pressures on local plant communities or areas (greater than 100 acres) that would lead to irreparable degradation to the range resource in terms of plant community composition or productivity
- Loss of forage or grazing area leading to a permanent reduction of 10 percent or greater in the allowable animal unit months for any of the permittees on the affected allotment
- Increased operational costs for any grazing permittees exceeding 100 percent of their grazing lease cost

3.6.2.1 Proposed Action

The proposed action would involve constructing a tailings impoundment in Sections 2 and 3 of T9N, R43E, and Section 35, T10N, R43E, resulting in an extension of the narrow grazing corridor between the Round Mountain Mine and State Highway 376 southward to the southern edge of Section 3. The extension would result in a narrow corridor approximately 3.5 miles long. The corridor would be 1,000 feet wide for approximately 2 miles at its south end, as opposed to the 1,200-foot width currently existing between the northern portions of the mining operation and the highway right-of-way. Construction of the fence to encompass the revised permit area would directly remove an additional 536 acres from grazing availability within the Smoky Allotment, including 232 acres of the shadscale vegetation community and 304 acres of the fourwing saltbush community. This area includes approximately 286 acres of unfenced rangeland within the current mine permit area and 250 acres outside the permit area.

The removal of 536 acres of available grazing from the allotment equates to approximately 0.4 percent of the 126,976-acre allotment. This forage loss would be replaced upon closure of the mine and the reclamation of disturbed areas associated with the proposed action. Thus, the direct forage loss, by itself, is not considered a significant adverse impact, and no immediate change is proposed in the number of permitted animal unit months on the allotment.

The narrow corridor between the mine and the highway currently exhibits symptoms of heavy over-grazing, including close cropping of palatable species (e.g., winterfat), very sparse grass and forb understory, and low plant density in comparison with the same plant community at other locations. Under the proposed action, heavy livestock congregation is expected to continue and likely increase around the mine dewatering channel in Sections 23 and 24, T10N, R43E, particularly during late spring and summer, since this is the primary local water source during that season. This congregation effect is compounded by the fact that the drainage channel occurs within a semiconfined area between the mine and the highway. In addition, the extension of the narrow corridor southwesterly along the highway is expected to result in adverse grazing impacts within this confined area as cattle move between the portion of the allotment remaining south of the mine and the primary summer water source at the northwest corner of the mine.

The proposed action is expected to accentuate an existing undesirable grazing distribution centered around the available water sources. The potential over-grazing and trampling effects in the corridor between the mine and the highway and around the dewatering channel are likely to result in the irreversible degradation of range resources in this area. These indirect effects are considered to constitute a significant environmental impact.

Potential range resource impacts associated with runoff from the leach offload piles are discussed in Section 3.2.2.1; mitigation for these impacts is identified in Section 3.2.4.

3.6.2.2 Range Management Alternative

This alternative would encourage better grazing distribution and would eliminate the current over-grazing situation near the mine dewatering channel through the development of an additional watering site north of the mine, installation of a new watering site south of the mine, and by fencing off the narrow corridor between the mine and State Highway 376 to preclude livestock access. This fence would remove the mine dewatering channel as a livestock watering source, thereby reducing grazing impacts in the area immediately around

the mine. This alternative would include removing grazing on 536 acres as outlined in the proposed action, plus restricting grazing in the 893 acres encompassed by fencing both ends of the corridor along the highway. The corridor area that would be enclosed by fencing consists of 522 acres of shadscale, 259 acres of fourwing saltbush, and 109 acres of rabbitbrush. The corridor would be used as a livestock driveway and would be subjected to grazing only a couple of times each year as livestock are moved between allotments. No reductions in animal unit months are proposed with this alternative, but some adjustment of animal unit months between the Smoky Allotment and San Antone Allotment would accompany the realignment of the allotment boundary to coincide with the southern edge of the mine permit area.

These adjustments would require the RO Ranch to haul water approximately three times each week during most of a 7-month period each year. A new 10,000-gallon tank would be installed by the SVCO approximately 3 miles north of the mine in SWSE Section 36, T11N, R43E. An additional tank would be installed by the RO Ranch at a new location south of the mine in SESW Section 23, T9N, R43E. The existing tank near the south end of the corridor area in Section 10, T9N, R43E would be left in place, but used only a few days each year as livestock are moved through the corridor. The substitution of these watering tanks for the current mine dewatering channel water source is expected to add a noticeable operational cost for the ranch operation. This cost increment would be incurred anyway, but at a later date under the no action alternative, since mine dewatering activities would cease at the completion of mining. The RO Ranch currently hauls water to three tanks south of the mine during its permitted grazing period for that area.

The construction of a fence by the SVCO along the north side of the Round Mountain road (State Highway 378) and encircling the Round Mountain townsite is expected to temporarily result in some congregation of livestock along the north side of this fence as cattle attempt to reach the mine dewatering channel where they are accustomed to watering. The congregation of livestock along the fence would be expected to diminish after the first few weeks following fence construction as the livestock become accustomed to the new water source north of the mine.

While this alternative would alleviate the expected significant impact to range resources in the vicinity of the mine dewatering channel, it is expected to result in additional operational costs to grazing permittees. These increased operational costs are not considered to constitute significant impacts when considered in relation to overall operating costs on the grazing allotment.

3.6.2.3 Tailings Impoundment Alternative

Construction of the tailings facility at this alternative location would negate the need to extend or constrict the narrow grazing corridor along State Highway 376, and thus would alleviate some of the expected increase in livestock congregation and grazing in the corridor and near the mine dewatering channel associated with the proposed action. The location of this alternative, however, would still contribute to a funnel effect for livestock around the dewatering channel, resulting in some increased grazing impacts in the area, although to a lesser extent than the proposed action.

The loss of available forage caused by developing this alternative would be similar to the proposed action because of the similar acreages and relatively comparable productivities of the associated plant communities. The area removed from grazing use outside of the existing permit area under this alternative would be approximately 439 acres.

The direct and indirect impacts to range resources associated with this alternative are not considered significant.

3.6.2.4 No Action Alternative

The no action alternative would have no impact on range resources since no disturbances beyond those presently permitted would occur. The current over-grazing situation along the mine drainage channel would continue under this alternative.

3.6.3 Cumulative Impacts

In addition to the existing and proposed operations of the Round Mountain Mine within the Smoky Allotment, grazing operations of the Russell Berg Ranch were affected by the 1989 reductions in allowable animal unit months on the allotment. That reduction amounted to approximately 24.4

percent for the Russell Berg Ranch. Thus, almost any additional reduction in allowable animal unit months for this ranch would constitute a significant cumulative impact on the operations. Because there is no planned reduction in animal unit months, no cumulative impact to the local ranching operations has been identified.

3.6.4 Monitoring and Mitigation Measures

Grazing pressure is closely related to the number and location of water sources for livestock. The SVCO has committed to providing and installing a 10,000-gallon water tank approximately 3 miles north of the Round Mountain Mine, and the RO Ranch has agreed to install an additional tank south of the mine. No additional mitigation measures for range resources are recommended under the range management alternative. Under the proposed action and the no action alternative, some additional mitigation measures may be necessary to alleviate the over-grazing situation near the mine dewatering channel. As an example, the dewatering stream could be piped to eliminate the attraction of livestock to this area.

3.6.5 Residual Adverse Effects

The residual adverse effects of the proposed action and the alternative tailings impoundment would be determined by the approaches and ultimate success of the reclamation program. Prompt reclamation resulting in the establishment of stable, productive forage species compatible with the surrounding natural plant communities would minimize the residual adverse effects to range resources.

3.7 Paleontological Resources

3.7.1 Affected Environment

No paleontological resources are known to occur within the existing or proposed project area (Shawe 1977, Kleinhampl and Ziony 1985). Paleozoic (Ordovician) limestones of the Zanzabar formation outcrop approximately 4 miles to the south. Fossil graptolites have been identified and described in this formation (Ferguson 1924), and it is possible that additional marine fossils could be encountered. A locality that produced a Pleistocene vertebrate is identified in the Manhattan Wash area approximately 8 miles to the south of the project area.

3.7.2 Environmental Consequences

To be considered significant, a paleontological resource must retain integrity and satisfy at least one of the criteria listed below:

- The resource is a unique or site-specific invertebrate or paleobotanical fossil occurring in formations that are found in the proposed project site.
- The resource qualifies as significant or critical and requires protection under the Antiquities Act of 1906.

Potential direct impacts to paleontological resources from the proposed action would be limited to areas of disturbance; potential indirect impacts could result from increased accessibility to fossil beds from improved transportation routes.

3.7.2.1 Proposed Action

There are no known paleontological resources in the project area; therefore, no direct impacts would occur to the resource. Indirect impacts may include unauthorized collection of specimens during and after construction, as well as during operation of the proposed mill and tailings facility. However, this is extremely unlikely because of specimen rarity.

3.7.2.2 Range Management Alternative

Since there are no known paleontological resources in the project area, there would be no adverse impacts to the resource under this alternative.

3.7.2.3 Tailings Impoundment Alternative

Since there are no known paleontological resources in the alternative tailings impoundment area, there would be no adverse impacts to the resource under this alternative.

3.7.2.4 No Action Alternative

There would be no impacts to paleontological resources associated with the no action alternative.

3.7.3 Cumulative Impacts

No direct or indirect adverse impacts to paleontological resources would occur with the proposed action or alternatives; therefore, no cumulative impacts to paleontological resources would occur.

3.7.4 Monitoring and Mitigation Measures

No monitoring or mitigation is recommended for this resource. Because fossils are usually buried, their locations cannot be confirmed until excavation occurs. If significant fossilferous deposits, specifically Tertiary vertebrate fossil deposits, are located during construction, operation, or reclamation, measures would need to be taken to identify and preserve the fossils.

3.7.5 Residual Adverse Effects

Since there are no known paleontological resources in the project area, there would be no adverse impacts to the resource; therefore, no residual adverse effects would occur.

3.8 Cultural Resources

3.8.1 Affected Environment

3.8.1.1 Prehistoric Background

The project area (see ***Figure 2-5***) is within the Central Subregion of the Western Subarea of the Great Basin (Jennings 1986: Figure 1; Elston 1986: Figure 1). Archaeological surveys and excavations in this subregion undertaken between 1963 and the late 1970s explored cultural and environmental relationships resulting in a cultural chronological sequence for nearby Monitor Valley extending from approximately 3500 B.C. to the arrival of Euro-Americans in the mid-nineteenth century (Thomas 1982: Table 1). Archaeological patterns are seen by Thomas (1982) to indicate that small, seasonally mobile groups subsisted on a wide variety of plants, small animals, and large animals, and relied heavily on pinenuts as a winter staple. This closely conforms to Steward's (1938) ethnographic findings, thus indicating relatively little cultural change during the past 6,000 years. Few, if any, traces of use of the area were found prior to approximately 6,000 years ago by Thomas and his colleagues. This is different from surrounding subregions of the Western Subarea, where the earliest occupation dates from 12,000 years ago (Elston 1986).

3.8.1.2 Historic Background

The main sources for the historic background of the proposed project area are Bowers and Muessig (1982), E.N. Moody (1980), and Tingley and Berger (1985). Because the historic background of the project area has been discussed in detail in various previous inventories (e.g., Burke and Furnis 1987), only a brief overview is included below.

The first Euro-American penetration into the area was by Jedediah Smith in 1827 and John C. Fremont in 1845. The 1860s brought occupation by farmers and ranchers in response to the mining boom in Austin. Small-scale mining of gold, antimony, and silver occurred at several locations in the Big Smoky Valley, but the Round Mountain townsite was not founded until 1906. The boom attracted numerous miners into the area, particularly from the town of Manhattan to the south with a wagon road connecting the two towns. The Round Mountain Mining District experienced fairly stable production through 1940, and produced approximately $8 million in ore. The District experienced several boom-and-bust cycles from 1936 until the 1970s when rising gold prices encouraged renewed development of the area.

3.8.1.3 Cultural Resources Identified in the Project Area

Several previous archaeological studies have been conducted in the vicinity of the project area. In 1975, a survey of a power line right-of-way was conducted by the Nevada Archaeology Survey for Sierra Pacific Power Company (Harrigan 1975). The electric line was to serve the Cameron Mining Company operation located 2 miles south of Round Mountain. No cultural resources were identified as a result of the survey.

Ball (1977) conducted a cultural resource inventory of a fence line for the Francisco Enclosure. The results of the survey were negative.

Rusco (1979) and her colleagues from the Nevada State Museum recorded 32 prehistoric sites and 2 historic sites during a power transmission line inventory. Of the prehistoric sites recorded, 28 were considered to be task/temporary camps (small lithic scatters with two or more kinds of tools and debitage, but no ground stone or fire-cracked rocks), 1 was a camp/task site, and 3 were large settlement sites. The settlement sites are located near water and contain large numbers of flaked stone tools and debitage, ground stone, hammerstones, and clusters of fire-cracked rocks. The two historic sites consist of a small trash scatter in the vicinity of Round Mountain and a cluster of stone buildings and foundations identified as the ruins of the Minnium Stage Station.

ERTEC Northwest, Inc. (1981) conducted an inventory of 30 proposed geotechnical test sites with a total area of approximately 40 acres. Of the 30 proposed test sites examined, 2 contained cultural resources. An isolated chert flake with some evidence of retouch or use was found at the site of one proposed observation test well, and a large lithic scatter containing obsidian and chert debitage and a brown chert knife base was observed at another proposed test well site.

In 1981, consultant archaeologists of the Nevada Department of Transportation recorded 5 lithic scatters, 1 campsite, and 15 isolated finds during a highway betterment and slope restoration survey of State Highway 376 (Seneca et al. 1981).

In 1983, a cultural resource inventory of a proposed 20-acre material pit and an existing access road was conducted by Nevada Department of Transportation consultant archaeologists. No cultural resources were identified as a result of the survey (F. Peterson 1983).

At the request of Sierra Pacific Power Company, Schock (1983) performed a cultural resource inventory for a proposed 6.1-mile-long 25kv transmission line running from Round Mountain to an existing 12.5kv line south of Round Mountain. With the exception of a modern and possibly historic trash dump along the survey area in the NE¼ NE¼ of Section 19, T10N, R44E, no cultural resources were reported.

Round Mountain Gold Corporation contracted Archaeological Research Services (ARS) to conduct a Class III inventory of over 6,000 acres (Burke and Furnis 1987). A total of 156 cultural resource locations were reported. The most notable of these is the site of the Round Mountain Mining District (CrNv-61-360). After eliminating 17 sites associated with modern debris, mining activities, or mining prospects and combining certain loci into a single site record (CrNv-61-360), 121 cultural resource locations remained. Of these, 13 were recorded as prehistoric (9 isolates and 4 lithic scatters); 37 are historic isolates; 55 are historic trash scatters; 9 are structural remains with associated trash scatters; 3 are in situ water pipelines, 1 at each end of a historic roadbed; a ditch; a dike complex; and a mine shaft. Burke and Furnis (1987) report that 11 of the sites contain diagnostic artifacts that pre-date 1920. In addition, 53 of the sites pre-date 1920, and 18 pre-date 1929, but none are earlier than 1900. Finally, seven sites could pre-date 1920 based on diagnostic maker's marks, but dates also range through the 1960s. Evaluative testing of historic loci Nos. 89 and 90 was conducted, but neither was found to be eligible for the National Register of Historic Places. Except for the Jett Canyon pipeline (CrNv-61-2182), the Jefferson Canyon pipeline (433-88), and the Fairview Mining Complex (433-98), none of the sites were considered to be eligible for nomination to the National Register of Historic Places.

In October of 1987, Nevada Department of Transportation consultant archaeologists conducted a cultural resource inventory of nine proposed material pit sites. Two prehistoric sites were recorded and include an isolated projectile point fragment (Rosegate) and a large diffuse lithic scatter containing debitage from local cryptocrystalline silicate drift, a biface fragment, and a small flake scraper/knife. Neither site was recommended as eligible for the National Register of Historic Places (F. Peterson 1987).

In January of 1987, Lynn Furnis of Archaeological Research Services conducted a Class III inventory for the SVCO airstrip. A single, isolated secondary flake of cryptocrystalline silicate material was observed and recorded.

Waski (1987) conducted a cultural resource inventory of approximately 75 acres, including a tie-down/hanger area, access road, and fence, for the SVCO airstrip. A small lithic scatter consisting of silicified siltstone debitage was recorded. In addition, two isolated flakes were recorded. None of the prehistoric resources recorded were recommended as eligible for the National Register of Historic Places.

Rafferty and DuBarton (1988) reported on a survey of 480 acres of Forest Service land. Three historic refuse scatters, one 1950s mining complex, one protohistoric/historic Shoshone brush shelter, and a historic house and dugout were recorded. The refuse scatters (26NY1672, 26NY1673, and 26NY1677) were not considered eligible for the National Register of Historic Places. The 1950s mining complex (26NY1674) also was not considered eligible, but additional photographs to accompany the site record were recommended. Additional mapping, recording, and limited testing were recommended for the brush shelter site (26NY1675). Finally, limited subsurface testing was recommended for the historic cabin site (26NY1676) to further evaluate its National Register of Historic Places potential.

The Division of Anthropological Studies was contracted to conduct archaeological testing and evaluation of archaeological sites 26NY1674, 1675, and 1676 (Edwards et al. 1990a). As previously noted, the 1950s mining complex 26NY1674 was not considered eligible for the National Register of Historic Places because of its relatively recent age (less than 50 years). Additional photographs were taken, and detailed recording of this site has exhausted any further research potential. Subsurface testing of the brush structure at site 26NY1675 indicates that the site is probably a fairly recent temporary shelter used by one or two people pursuing ranching or hunting

activities and is probably not of aboriginal construction. Recording and testing of this site have exhausted any further data potential. Subsurface testing of the stone cabin site (26NY1676) reveals that the cabin "appears to have functioned as both a domestic residence and a limited industrial site" (Edwards et al. 1990a). The site was occupied from circa 1910 to 1935, and its occupants apparently were engaged in small-scale mining activities (prospecting). An attempt to link the site to a specific individual or mining operation through documentary research failed (Edwards et al. 1990a). While the testing program at 26NY1676 yielded useful comparative data, further archaeological investigation would prove redundant, and no further work was recommended.

Edwards (1990b) reported on the detailed mapping, recording, photography, and limited subsurface testing of two features within site CrNv-61-360: the Fairview Mining Complex (Feature 433-98), which is partly within the Round Mountain townsite area, and Feature 433-100. Significant information regarding "past lifeways and social behavior of the site's former occupants, particularly from the trash dumps and, to a lesser degree, from the structural remains was recovered from the site" (Edwards 1990b). Edwards (1990b) concludes that:

> *the site's significant data pertaining to historic social patterns and lifestyles has been depleted through the current project, and subsurface testing indicates that the site lacks significant depth suggesting that additional excavation would be relatively unproductive. Further archaeological investigation at the site would be redundant, and no additional work is recommended for site 26NY5989, the Fairview Mining Complex.*

In September of 1990, the BLM conducted a survey for cultural resources in a project-related inventory for the San Antone Water Haul No. 1 (Whalley 1990). A trash scatter was located, and the BLM resource area archaeologist determined that the scatter was modern. Since all trash was found to be recent, the inventory was negative, and the project was recommended for approval.

Between October 10 and 16, 1991, crews from Western Cultural Resources Management, Inc. performed a Class III archaeological survey of 960 acres in Nye County, Nevada, for Round Mountain Gold Corporation. The survey was for a proposed leach-pad facility to be located on the eastern edge of the Big Smoky Valley, approximately 3 miles southwest of the town of Round Mountain. One prehistoric, one unknown, and eleven historic features, or feature complexes, were located during the survey. In addition, 16 isolated artifacts were recorded. None of the features retain sufficient integrity or have associations that would warrant eligibility to the National Register of Historic Places; therefore, no further archaeological work was recommended.

Prehistoric Resources. Of the 161 cultural resources recorded within the project area (***Table 3-28***), a total of 16 are prehistoric loci, including isolated artifacts, lithic scatters, and stone circles (***Table 3-29***). There are six loci in the project area that are identified as or that may be prehistoric sites.

With one doubtful exception, all prehistoric loci recorded in the project area date to the past 6,000 years; however, few have yielded the chronologically diagnostic artifacts that permit assignment to specific phases in Thomas' (1982: Table 1) sequence.

1. CrNv-61-360, Feature 6-1431-B, is a sparse scatter of flaked stone artifacts consisting of the debris of tool production, including biface fragments, all of a brown/tan banded siltstone, and the base of an obsidian side-notched projectile point.

2. CrNv-61-360, Feature 6-1431-M, is a circular arrangement of 14 rocks, each slightly buried; the circle is approximately 2 meters (6 feet) in diameter. No artifacts were observed in or near this feature.

3. 26NY1675 is described in a short report (Rafferty 1989) as "a single course of rhyolitic boulders and brush abutting a large shale bedrock outcrop on the slope of a large wash." Test excavations in and near this feature were recommended by the recording archaeologist in order to determine when, by whom, and for

TABLE 3-28
National Register of Historic Places Status of Cultural Resources Within the Project Area

Agency Site No. or Smithsonian No.	Brief Loci Description	Project Association	NRHP Potential	Project Disturbance	Mitigation
Round Mountain Gold Corporation Dedicated Pad Expansion (Peterson and Stoner 1992) BLM CRR-6-1431 (P) CrNv-61-360					
Feature					
6-1431-A	Historic Trash Scatter		NEL	NA	NA
6-1431-B	Lithic Scatter		NEL	NA	NA
6-1431-C	Historic Trash Scatter		NEL	NA	NA
6-1431-D	Historic Trash Scatter		NEL	NA	NA
6-1431-E	Prospect Pits with Trash Scatter		NEL	NA	NA
6-1431-F	Historic Trash Scatter		NEL	NA	NA
6-1431-G	Historic Trash Scatter		NEL	NA	NA
6-1431-H	Prospect Pit, Hearth, and Trash Scatter		NEL	NA	NA
6-1431-I	Prospect Pit with Trash Scatter		NEL	NA	NA
6-1431-J	Building Platforms, Trash Scatter		NEL	NA	NA
6-1431-K	Trash Scatter		NEL	NA	NA
6-1431-L	Trash Scatter		NEL	NA	NA
6-1431-M	Stone Circle		NEL	NA	NA
Fairview Mining Complex (Edwards 1990b) BLM CRR-6-1301-1					
26NY5989	Fairview Mining Complex - originally CrNv-61-360, Feature 98		E	ND	AV
Archaeological Testing and Evaluation Sites 26NY1674, 26NY1675, 26NY1676 (Edwards et al. 1990a) Forest Service Report TY89-546					
26NY1672	Historic Artifact Scatter		NEL	NA	NA
26NY1673	Historic Artifact Scatter		NEL	NA	NA
26NY1674	Mining Complex		NEL	NA	NA
26NY1675	Stone and Brush Ring		NEL	NA	NA
26NY1676	Stone Cabin, Dugout, Trash Scatter		NEL	NA	NA
26NY1677	Historic Artifact Scatter		NEL	NA	NA
SVCO Expansion Project (Burke and Furnis 1987) BLM CR-6-1045 (P) CrNv-61-360, Feature 433					
2	Historic Trash Scatter		NEL	NA	NA
3	Historic Trash Scatter		NEL	NA	NA
4	Historic Trash Scatter		NEL	NA	NA
5	Historic Trash Scatter		NEL	NA	NA
6	Historic Trash Scatter		NEL	NA	NA
7	Historic Trash Scatter		NEL	NA	NA
8	Lithic Isolate		NEL	NA	NA
9	Historic Trash Scatter		NEL	NA	NA
10	Historic Isolate		NEL	NA	NA
11	Historic Pipe Fragment		NEL	NA	NA

TABLE 3-28
National Register of Historic Places Status of Cultural Resources Within the Project Area (Continued)

Agency Site No. or Smithsonian No.	Brief Loci Description	Project Association	NRHP Potential	Project Disturbance	Mitigation
12	Historic Trash Scatter		NEL	NA	NA
13	Historic Trash Scatter		NEL	NA	NA
14	Historic Isolate		NEL	NA	NA
16	Historic Isolate		NEL	NA	NA
17	Historic Trash Scatter		NEL	NA	NA
18	Historic Trash Scatter		NEL	NA	NA
19	Historic Isolate		NEL	NA	NA
20	Historic Trash Scatter		NEL	NA	NA
21	Historic Isolate		NEL	NA	NA
22	Historic Isolate		NEL	NA	NA
23	Historic Trash Scatter		NEL	NA	NA
24	Historic Isolate		NEL	NA	NA
26	Historic Isolate		NEL	NA	NA
29	Mining Prospects, Rock Cairn, Tobacco Can		NEL	NA	NA
31	Historic Trash Scatter		NEL	NA	NA
32	Historic Trash Scatter		NEL	NA	NA
34	Mining Prospect, Historic Isolate		NEL	NA	NA
35	Mining Prospect, Historic Trash Scatter		NEL	NA	NA
36	Prehistoric Isolate		NEL	NA	NA
37	Historic Trash Scatter		NEL	NA	NA
38	Historic Trash Scatter		NEL	NA	NA
39	Lithic Scatter		NEL	NA	NA
40	Historic Isolate		NEL	NA	NA
41	Prehistoric Isolate		NEL	NA	NA
42	Historical Structural Remain, Trash Scatter		NEL	NA	NA
43	Mining Prospect, Trash Scatter		NEL	NA	NA
44	Mining Prospect, Trash Scatter		NEL	NA	NA
45	Historic Trash Scatter		NEL	NA	NA
46	Historic Trash Scatter		NEL	NA	NA
47	Historic Isolate		NEL	NA	NA
49	Prehistoric Isolate		NEL	NA	NA
50	Historic Trash Scatter		NEL	NA	NA
51	Historic Bridge Structure		NEL	NA	NA
53	Historic Trash Scatter		NEL	NA	NA
54	Historic Trash Scatter		NEL	NA	NA
55	Historic Isolate		NEL	NA	NA
56	Historic Isolate		NEL	NA	NA
57	Historic Trash Scatter		NEL	NA	NA

TABLE 3-28
National Register of Historic Places Status of Cultural Resources Within the Project Area (Continued)

Agency Site No. or Smithsonian No.	Brief Loci Description	Project Association	NRHP Potential	Project Disturbance	Mitigation
58	Historic Isolate		NEL	NA	NA
59	Historic Trash Scatter		NEL	NA	NA
62	Prehistoric Isolates		NEL	NA	NA
63	Mining Prospects		NEL	NA	NA
64	Historic Trash Scatter		NEL	NA	NA
66	Historic Trash Scatter		NEL	NA	NA
67	Historic Isolate		NEL	NA	NA
68	Historic Trash Scatter		NEL	NA	NA
69	Lithic Scatter		NEL	NA	NA
70	Historic Trash Scatter		NEL	NA	NA
71	Historic Isolate		NEL	NA	NA
72	Mining Prospect, Historic Trash Scatter		NEL	NA	NA
73	Historic Trash Scatter		NEL	NA	NA
74	Historic Trash Scatter		NEL	NA	NA
75	Historic Isolate		NEL	NA	NA
76	Historic Trash Scatter		NEL	NA	NA
77	Historic Trash Scatter		NEL	NA	NA
78	Historic Trash Scatter		NEL	NA	NA
79	Historic Trash Scatter		NEL	NA	NA
80	Historic Structure, Trash Scatter		NEL	NA	NA
81	Lithic Scatter		NEL	NA	NA
82	Historic Isolate		NEL	NA	NA
83	Historic Pipeline		NEL	NA	NA
84	Historic Isolate		NEL	NA	NA
85	Lithic Isolate		NEL	NA	NA
86	Lithic Isolate, Historic Isolate		NEL	NA	NA
87	Mineshaft, Historic Trash Scatter		NEL	NA	NA
89	Jefferson Canyon-Shoshone Canyon Pipeline		E	ND	AV
89	Historic Structure, Prospects, Historic Trash Scatter		NEL	NA	NA
90	Complex of Historic Structure, Rock and Adobe Foundation, Shafts, Prospects, Historic Trash Scatter		NEL	NA	NA
91	Historic Trash Scatter		NEL	NA	NA
92	Historic Isolate		NEL	NA	NA
93	Historic Isolate		NEL	NA	NA

TABLE 3-28
National Register of Historic Places Status of Cultural Resources Within the Project Area (Continued)

Agency Site No. or Smithsonian No.	Brief Loci Description	Project Association	NRHP Potential	Project Disturbance	Mitigation
94	Historic Trash Scatter		NEL	NA	NA
95	Historic Structure, Trash Scatter		NEL	NA	NA
96	Historic Road		NEL	NA	NA
97	Prehistoric Isolate		NEL	NA	NA
9[illegible]	(See Fairview Mining Complex)			NA	NA
9[illegible]	Stope, Bottle Glass Fragments, Can		NEL	NA	NA
100	Historic Trash Scatter in Prospect/Privy Pit		NEL	NA	NA
101	Historic Trash Scatter		NEL	NA	NA
102	Historic Wooden Pipe		NEL	NA	NA
10[illegible]	Historic Structure - Rock Dam/Bridge		NEL	NA	NA
10[illegible]	Historic Trash Scatter		NEL	NA	NA
105	Historic Trash Scatter		NEL	NA	NA
106	Stope, Historic Trash Scatter		NEL	NA	NA
107	Historic Trash Dump		NEL	NA	NA
10[illegible]	Historic Trash Dump		NEL	NA	NA
109	Prehistoric Isolate		NEL	NA	NA
11[illegible]	Historic Structure		NEL	NA	NA
111	Historic Trash Scatter		NEL	NA	NA
1[illegible]2	Historic Trash Scatter		NEL	NA	NA
113	Historic Trash Scatter		NEL	NA	NA
11[illegible]	Historic Isolate		NEL	NA	NA
116	Historic Trash Scatter		NEL	NA	NA
1[illegible]7	Mining Prospect		NEL	NA	NA
11[illegible]	Historic Trash Scatter		NEL	NA	NA
119	Historic Isolate		NEL	NA	NA
120	Historic Trash Scatter		NEL	NA	NA
12[illegible]	Historic Trash Scatter		NEL	NA	NA
12[illegible]	Structure, Trash Scatter		NEL	NA	NA
123	Structure, Trash Scatter		NEL	NA	NA
124	Historic Trash Scatter		NEL	NA	NA
124a	Historic Isolate		NEL	NA	NA
125	Historic Trash Scatter - Round Mountain Dump Site		NEL	NA	NA
126	Historic Isolate		NEL	NA	NA
127	Mining Prospect		NEL	NA	NA
128	Historic Trash Scatter		NEL	NA	NA
129	Historic Isolate		NEL	NA	NA

TABLE 3-28
National Register of Historic Places Status of Cultural Resources Within the Project Area (Continued)

Agency Site No. or Smithsonian No.	Brief Loci Description	Project Association	NRHP Potential	Project Disturbance	Mitigation
130	Historic Trash Scatter		NEL	NA	NA
131	Historic Isolate		NEL	NA	NA
132	Historic Trash Scatter		NEL	NA	NA
133	Historic Trash Scatter		NEL	NA	NA
134	Historic Isolate		NEL	NA	NA
135	Historic Trash Scatter		NEL	NA	NA
136	Historic Trash Scatter			NA	NA
137	Historic Trash Scatter		NEL	NA	NA
138	Historic Isolate		NEL	NA	NA
139	Mining Prospect, Historic Trash Scatter		NEL	NA	NA
140	Historic Trash Scatter		NEL	NA	NA
141	Historic Trash Scatter		NEL	NA	NA
142	Historic Isolate		NEL	NA	NA
143	Historic Trash Scatter		NEL	NA	NA
144	Historic Isolate		NEL	NA	NA
145	Historic Isolate		NEL	NA	NA
146	Historic Trash Scatter		NEL	NA	NA
147	Prehistoric Isolate		NEL	NA	NA
149	Two Earthen Dikes		NEL	NA	NA
150	Mining Feature - Shaft		NEL	NA	NA
151	Historic Isolate		NEL	NA	NA
152	Historic Isolate		NEL	NA	NA
156	Historic Structure, possible Ethnohistoric Shoshone Adobe Structure		E	ND	AV
NRHP (Nevada Division of Historic Preservation and Archaeology 1985)					
	William H. Berg House		E	ND	AV
National Historic Engineering Site Inventory (Adde 1979)					
CrNv-61-2182	Jett Canyon Pipeline		NEV	ND	AV

E = Eligible (State Historic Preservation Office concurrence)
JE = Judge eligible
NEV = Eligible pending further evaluation (State Historic Preservation Office concurrence)
ND = No Disturbance
AV = Avoid
ME = Mitigative Excavations
NEL = Not Eligible
NA = Not Applicable

TABLE 3-29
Cultural Resource Types and Numbers

Resource Type	Number
Prehistoric Loci	
Isolated Lithic Artifacts	10
Lithic Scatters	4
Prehistoric Stone Circles	2
Prehistoric Resources Total	16
Historic Archaeological Loci	
Building Platform	1
Historic Isolates	34
Mine Shafts	2
Stopes	2
Trash Scatters	72
Historic Architectural Loci	
Ethnohistoric Shoshone Adobe Structure	1
Building Vestiges	1
Mining Complexes (including the Fairview)	2
Structures	8
Structure Complex	1
William H. Berg House	1
Historic Engineering Loci	
Bridge Structure	1
Earthen Dike	1
Pipelines (including 1 wooden)	4
Road	1
Historic Landscape Loci	
Prospecting Loci	13
Historic Resources Total	145
Total Prehistoric and Historic Resources	161

what it may have been occupied. A filtered cigarette butt (potentially more than 50 years old) was the only artifact recovered during the excavation of a 3 feet by 6 feet test pit to a depth of approximately 1.5 feet and a small series of shallow shovel tests. The artifact, which was retrieved from the interior of the structure, can be dated reliably to no earlier than 1928. It was determined that the feature is a recent, temporary shelter, probably occupied by a wrangler or hunter, both of whom are known to frequent the area (Edwards et al., 1990).

4. CrNv-61-360, Feature 433-39, is a small prehistoric site with a basalt flake and a projectile point on the surface. The point, identified as a Great Basin Stemmed series point, may be better classified on the basis of the scale drawing in the site record as a Pinto series point. The former indicates that the site was probably occupied more than 7,000 years ago, and the latter that it may date to later than 5,000 years ago.

5. CrNv-61-360, Feature 433-81, is a surface scatter of basalt, obsidian, and a variety of microcrystalline silicate stone; a small triangular point, classified as Cottonwood series, indicates the site has been used during the past 800 to 900 years.

In addition, there are ten isolated lithic artifacts that have been recorded in the project area.

All of these resources have been judged ineligible for the National Register of Historic Places, presumably on the basis of a lack of potential to yield information. This does not preclude their being regarded by Shoshone people as eligible for

consideration as Traditional Cultural Properties and, as such, eligible for the National Register of Historic Places.

One other previously recorded historic resource has been judged to be eligible for the National Register of Historic Places and may possibly be related to Native Americans; Site CrNv-61-360, Feature 433-156, is described as a historic adobe structure, possibly ethnohistoric Shoshone. All other archaeological or structural features in the proposed project area are clearly related to the various stages of mining and occupation of the original Round Mountain mining camp.

Historic Resources. Of the 161 loci recorded within the project area (***Table 3-28***), 145 are historic and consist of the following:

- Historic archaeological loci, primarily isolated artifacts and trash scatters as well as a building platform, mine shafts, and stopes
- Architectural loci, including structures, building vestiges, mining complexes, and a structure complex
- Engineering loci composed of a bridge structure, an earthen dike, pipelines, and a road
- Landscape loci composed of prospecting sites

Table 3-29 gives complete counts of each loci type.

3.8.1.4 Ethnography

The project area and its surrounding cumulative impact area are within the traditional homeland of descendants of a large ethnic group, the Western Shoshone (***Figure 3-25***). Specifically, the project area is part of the core territory of the Big Smoky Valley people (Steward 1938; and Figure 8; Thomas et al. 1986).

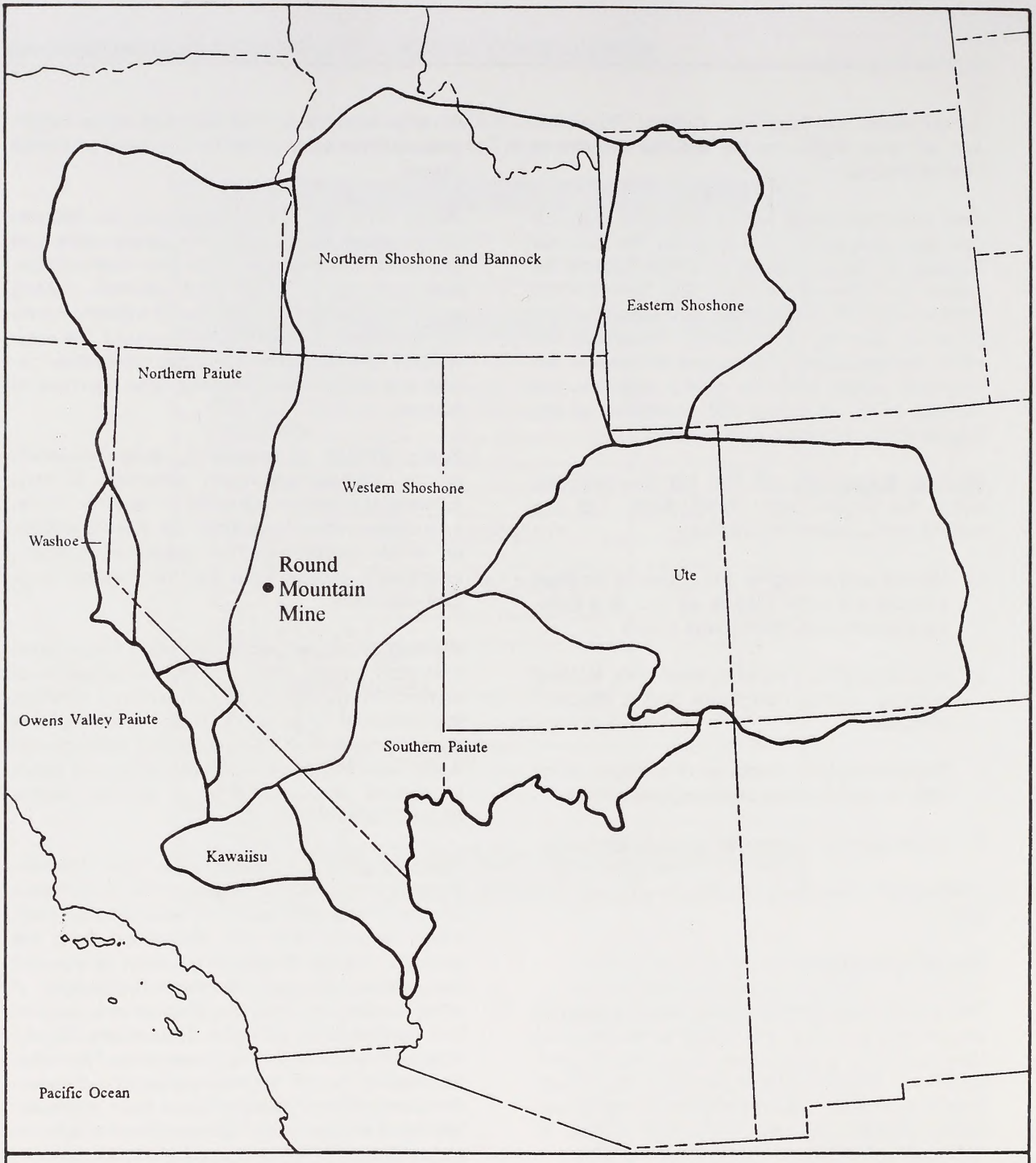
Ethnographic and Ethnohistorical Information. Western Shoshone people have occupied the Great Basin for many centuries. Many of them see themselves as the original human occupants of their present territory, who arrived in mythic times. Creation stories and other important myths feature prominent mountain peaks now honored as sacred places.

Before the arrival of Euro-Americans, the Western Shoshone people hunted and gathered native food and medicinal resources. They also used available local materials to make tools, shelters, hunting gear, and weapons, the remains of which comprise the prehistoric archaeological record of the area. Nuclear families were the basic socioeconomic unit, but camps often included other relatives or friends.

Spring through early autumn, small household groups traveled within an extended territory, following the harvest-schedule of essential foods, and rejoined other households for a more extended winter settlement. The boundaries between neighboring groups were flexible, creating large joint-use areas.

Western Shoshone people, like other North American tribal groups, accept a religious obligation of stewardship for their traditional territory. Although the traditional religious beliefs and practices have changed much over the past century, many persist today, including rituals of thanksgiving and rituals to request the assistance of spiritual beings (Rusco 1994).

Involved Tribal Groups. The two Western Shoshone reservations closest to the project area are the Yomba and Duckwater reservations, which have members who are descended from the people of the Big Smoky and Monitor valleys and from related Western Shoshone subgroups. A small number of Western Shoshone individuals and families living in Austin, Gabbs, and Eureka may also have ties to the project area. The Tribal Councils of the two reservations and the Western Shoshone National Council have been contacted and sent copies of an ethnographic background paper (Rusco 1994). In response to their request, a site visit was conducted for members of the Yomba Shoshone Tribe in June 1994. The site visit focused on archaeological and historic resources of interest to the Tribal members. The Tribal members could see that no impacts had occurred in their areas of concern and were assured by the



0 50 100 Miles

0 50 100 Kilometers

N

LEGEND

State Boundaries

Tribal Territories

Source: Steward 1938

Round Mountain Mine

Figure 3-25

Great Basin Tribal Groups

BLM and SVCO that the proposed project or the alternatives would not affect sites of cultural and historic interest to the Tribe.

3.8.2 Environmental Consequences

The significance of a cultural resource is an assessment of the importance of a cultural resource to the citizens of the United States that indicates whether a site has attributes that qualify it for inclusion in the National Register of Historic Places. In order to be considered eligible for inclusion in the National Register of Historic Places, a cultural resource must retain integrity and satisfy at least one of the four significance criteria defined in 36 Code of Federal Regulations part 60.4. These criteria are listed below.

- 36 Code of Federal Regulations 60.4a—Associated with events significant to broad patterns of history
- 36 Code of Federal Regulations 60.4b—Associated with the lives of persons significant in the past
- 36 Code of Federal Regulations 60.4c—Embody distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a distinguishable entity whose components lack individual distinction
- 36 Code of Federal Regulations 60.4d—Yielded or may yield information important to history or prehistory

Table 3-28, presented previously, lists all resources within the project area and their National Register of Historic Places status.

Direct physical impacts to cultural resources could occur during ground-disturbing activities associated with constructing the proposed tailings impoundment, as well as reclamation activities around the existing mine. Indirect impacts could result from increased erosion or improved access, which makes sites more vulnerable to accidental or deliberate disturbance and illegal collecting.

Physical alteration of the prehistoric sites and historic archaeological sites diminishes the historical integrity of the resource with respect to its cultural setting. Any adverse impact to a cultural resource that is eligible for inclusion in the National Register of Historic Places is considered a significant impact. An undertaking is regarded as having an effect on a cultural property if it alters any of the characteristics that may qualify the property for inclusion in the National Register of Historic Places. An adverse effect can only be incurred by sites that have been identified as significant cultural resources eligible for inclusion in the National Register of Historic Places. An undertaking is always considered to have no adverse effect or no effect if all sites in the area have been shown to be insignificant/not eligible or the impacts to the qualities that make the sites significant are mitigated as defined in 36 Code of Federal Regulations 800.9(c)1.

3.8.2.1 Proposed Action

None of the sites within the proposed area of disturbance are eligible for the National Register of Historic Places; therefore, there are no properties (36 Code of Federal Regulations 800.4d) and consequently, there are no effects, either direct or indirect, adverse or not adverse.

3.8.2.2 Range Management Alternative

None of the sites within the area of disturbance for this alternative are eligible for the National Register of Historic Places; therefore, there are no properties (36 Code of Federal Regulations 800.4d) and consequently, there are no effects, either direct or indirect, adverse or not adverse.

3.8.2.3 Tailings Impoundment Alternative

None of the sites within the area of disturbance for this alternative are eligible for the National Register of Historic Places; therefore, there are no properties (36 Code of Federal Regulations 800.4d) and consequently, there are no effects, either direct or indirect, adverse or not adverse.

3.8.2.4 No Action Alternative

None of the sites within the no action alternative are eligible for the National Register of Historic Places; therefore, there are no properties (36 Code of Federal Regulations 800.4d) and consequently, there are no effects, either direct or indirect, adverse or not adverse.

3.8.3 Cumulative Impacts

No direct or indirect adverse impacts are anticipated with implementation of the proposed action or the alternatives; therefore, no cumulative impacts would occur to cultural resources in the cumulative impact area.

3.8.4 Monitoring and Mitigation Measures

The SVCO recognizes the serious consequences of disturbance and unauthorized collection of cultural resources.

CR1: In compliance with the Archaeological Resources Protection Act of 1979, as amended (16 USC 470), the following information will be distributed to all consultants, contractors, and employees of the SVCO:

> *SVCO activities in the proposed project area are being conducted within an area of potential prehistoric and historic significance. Undue and unauthorized impacts to the resources carries a significant penalty: up to $100,000 fine, up to a 5-year jail sentence, cost of restoration, value of resource, and forfeiture of vehicle or equipment.*
>
> *Protect your Country's resources, report violations to the land management agency responsible for the location where the violation took place. On public land, contact either the U.S. Forest Service or the Bureau of Land Management. Your information may be valuable. Reward can be up to $500.*

3.8.5 Residual Adverse Effects

The proposed project would have no direct adverse impact on significant cultural properties within the proposed project area. The proposed action would result in the alteration or destruction of some non-significant prehistoric sites and historic archaeological sites during project construction; however, these sites are not eligible for the National Register of Historic Places, a determination of no effect with no further work necessary has been made, and the impacts are not considered significant. Therefore, no residual adverse effects would occur.

3.9 Air Quality

3.9.1 Affected Environment

Baseline meteorology, air quality, and dispersion conditions at the project site were characterized from on-site data and data records from the closest commercial monitoring stations in central Nevada (Tonopah and Austin). The SVCO also has operated two stations near the site since 1985.

3.9.1.1 Temperature and Precipitation

Table 3-30 contains summaries of temperature and precipitation measurements from Tonopah and Austin, Nevada, which are the two monitoring stations closest to Round Mountain (46 miles south and 56 miles north, respectively). Both locations are similar in elevation and terrain to the project site; therefore, data from these stations are considered representative of the immediate project area. On-site temperature and precipitation measurements taken near the Round Mountain Mine since 1992 are also listed in ***Table 3-30***.

Temperature data indicate a relatively large amount of diurnal and seasonal variability, which is typical of dry climates. The warmest temperatures occur in late July or early August, and the coldest occur in January. Extremes can range from 105°F in the summer to -15°F in the winter.

The data specific to the Round Mountain site for 1992 through 1994 show a maximum temperature of 91°F in June, July, and August and a minimum of +1°F in January. During the 2 years of data collection, the annual mean temperature at the Round Mountain site was 52°F. This mean compares closely with those from Tonopah and Austin.

Precipitation in this portion of Nevada is normally sparse, averaging only approximately 5 to 10 inches annually, with increasing levels of precipitation at higher elevations. Analysis of on-site data collected during 1994 and 1995 indicates an average total of slightly less than 8 inches, which falls between the Tonopah and Austin average totals. Monthly variability in precipitation amounts is not significant.

3.9.1.2 Winds

The proposed project is located in complex terrain where the winds are affected by local topographic features. This is evident in the on-site wind data collected during 1993, which show predominant winds blowing along the valley parallel to the major mountain ranges. Ten-meter wind speed and direction were measured at two separate sites: (1) near the northwest edge of the Round Mountain townsite (north site) and (2) approximately 1 mile south of the Round Mountain Mine (south site).

The south site is located in open terrain and, as such, best represents general surface windflow near Round Mountain. The north site is located near the mining waste dumps, which affect both speed and direction of the wind.

An annual windrose for each monitoring site is included in ***Figures 3-26*** and ***3-27***. These data show the directions from which the wind blows. Wind directions were most frequently from either the north or south along the orientation of the Big Smoky Valley. Predominant wind direction for the north site was from the south, with an average speed of 8.3 miles per hour. Almost one-half of all winds were from the southeast through southwest quadrants, showing the blocking effect of the nearby waste dumps. At the south site, a similar wind pattern was noted. However, the south site experienced a slightly higher frequency of winds from the northerly quadrants, with an average speed of 9.8 miles per hour. The strongest winds generally occurred from the south at both locations.

3.9.1.3 Dispersion Conditions

Dispersion conditions at Round Mountain are affected by two parameters: stability and mixing depth. Stability is defined as the ability of the atmosphere to disperse a given pollutant concentration. Unstable conditions represent maximum dispersion, while minimum dispersion occurs during stable conditions. Mixing depth defines the atmospheric volume through which dispersion may take place.

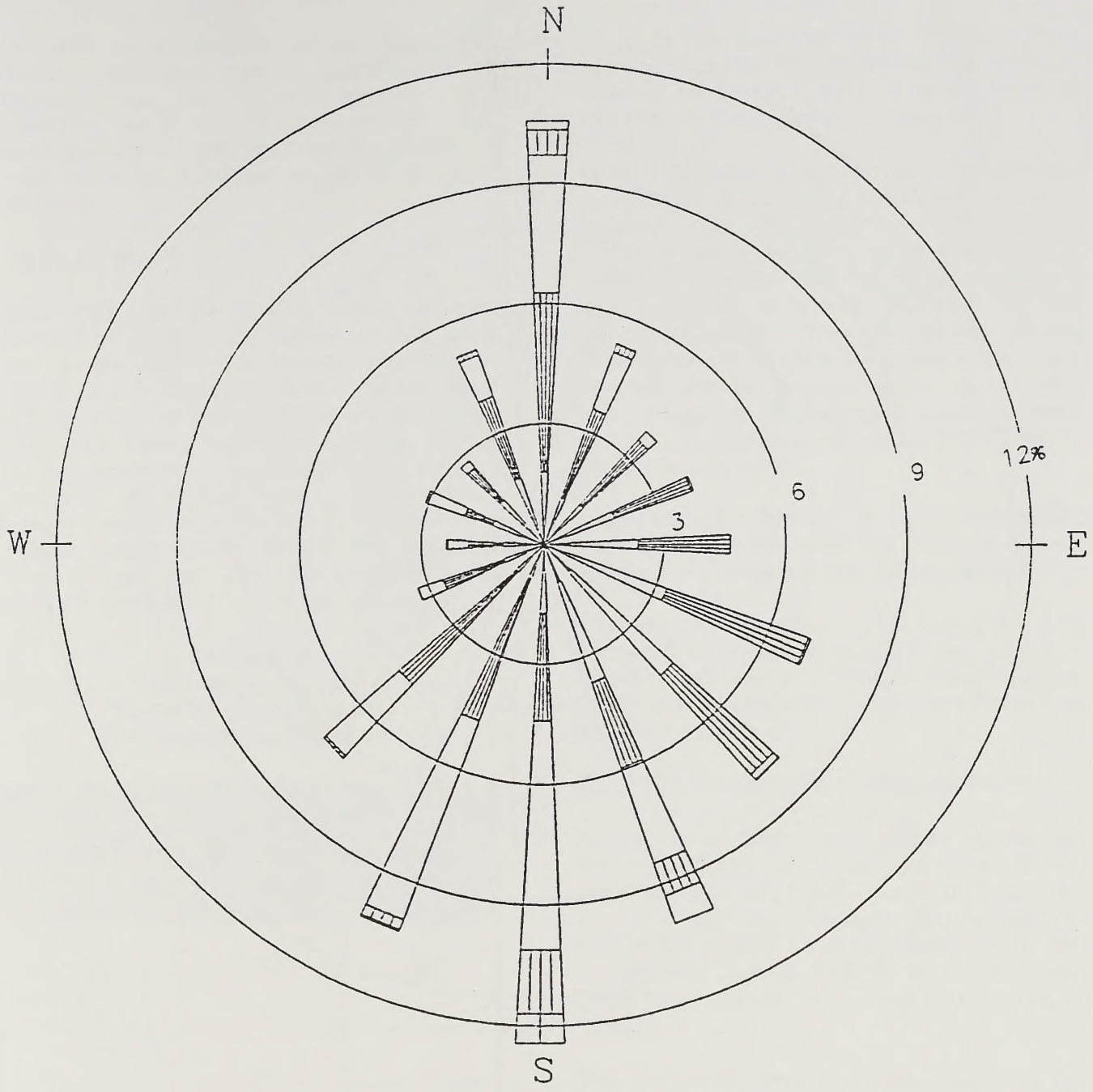
Estimates of atmospheric stability taken from 1973 to 1977 at Tonopah indicate that approximately 24 percent of the observations was associated with unstable conditions, 35 percent with neutral conditions, and 42 percent with stable conditions. Average wind speeds are highest for neutral conditions and decrease as the stability and/or instability increases. Mixing depths are greatest during the afternoon hours and during the summer, when incoming solar radiation is strongest.

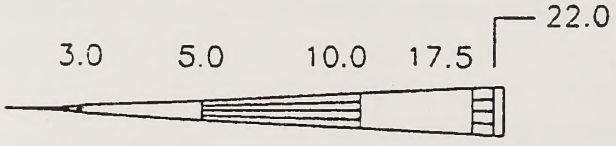
TABLE 3-30
Regional Temperature and Precipitation Data

Station	Elevation (feet)	Years of Record	Period of Record		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum, Minimum, and Mean Temperatures (F°)																	
Tonopah	5,426	33	1936-1968	Max	65	68	77	83	94	102	104	100	96	87	73	70	104
				Min	-15	-7	6	9	18	26	40	31	23	15	2	-13	-15
				Mean	30.1	34.7	39.8	48.7	56.8	63.3	73.9	71.8	64.3	52.9	38.8	33.5	50.7
Round Mountain	6,050	2	1992-1994	Max	57	61	68	77	82	91	91	91	88	79	64	57	91
				Min	1	12	19	25	32	32	45	48	39	34	10	7	1
				Mean[1]	32.5	33.8	44.1	50.0	59.5	65.7	70.7	73.4	64.4	53.6	36.5	34.7	51.6
Austin	6,543	33	1936-1968	Max	65	67	74	80	88	97	102	98	97	86	74	67	102
				Min	-15	-13	-3	3	12	25	38	30	18	13	-5	-7	-15
				Mean	27.2	31.1	35.3	43.3	51.3	59.6	70.0	68.3	60.6	50.1	37.9	32.2	47.2
Mean Monthly Precipitation (total inches)																	
Tonopah	5,426	33	1936-1968		0.31	0.37	0.55	0.58	0.47	0.24	0.43	0.33	0.40	0.47	0.45	0.37	5.08
Round Mountain	6,050	2	Jan. 1994 - March 1995		1.06	0.28	1.13	1.03	1.04	0.00	0.20	0.00	0.60	0.76	1.00	0.60	7.70
Austin	6,543	33	1936-1968		1.06	1.12	1.51	1.49	1.33	1.13	0.56	0.51	0.47	1.07	0.93	1.08	12.12

[1] Because of the limited data available at this station, the means shown here have been calculated as the average of the monthly maximum and minimum rather than as the average of mean daily temperatures, which was done at the other stations.

Source: National Climatic Center, Asheville, NC





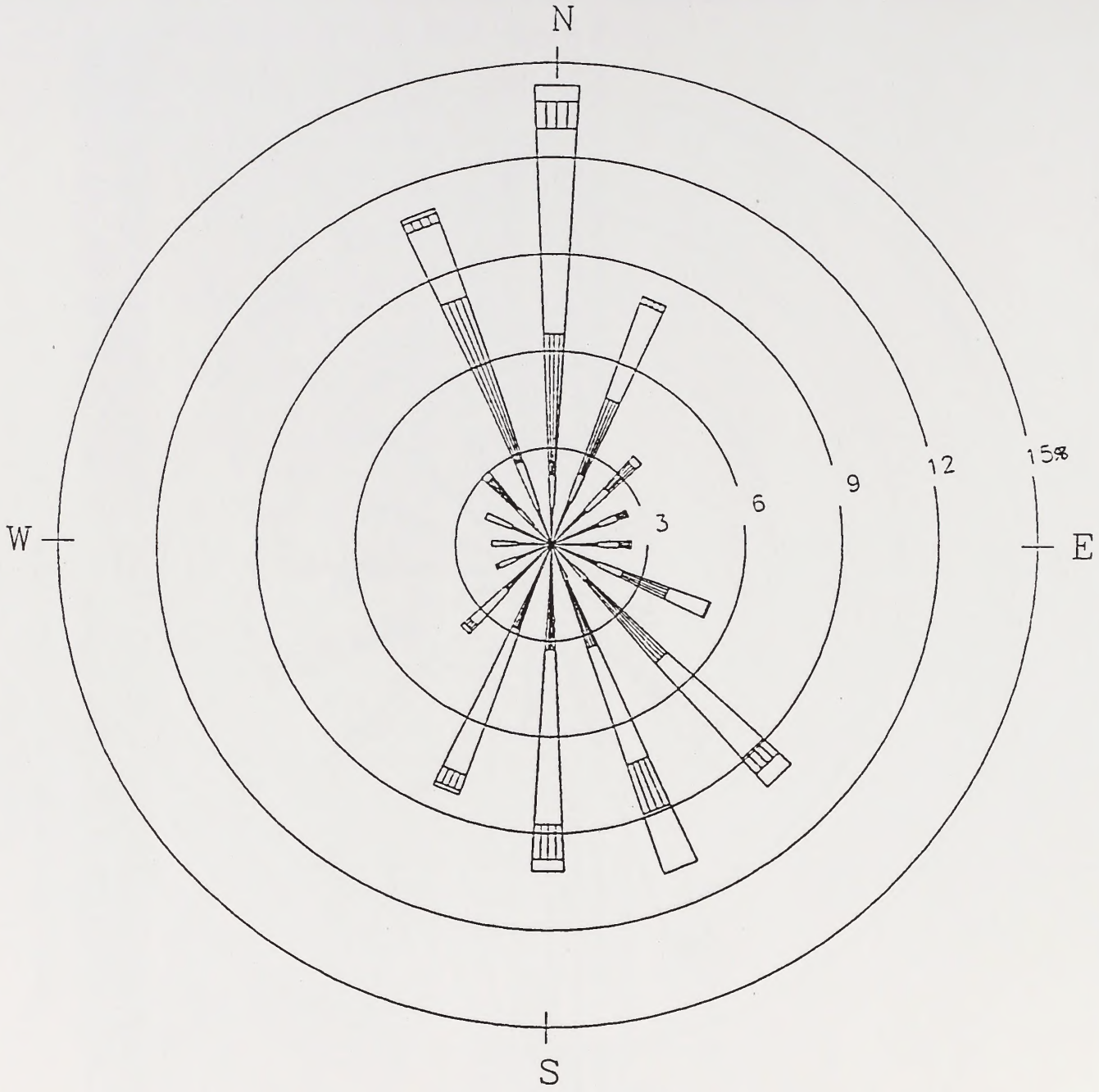
WIND SPEED CLASS BOUNDARIES
(Miles/Hour)

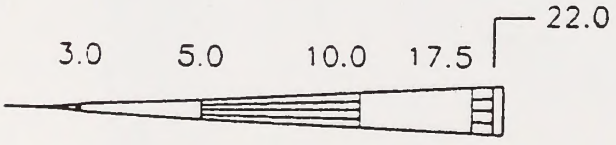
Notes: Diagram is of the frequency of occurrence for each wind direction.
Wind direction is the direction from which the wind is blowing.
General example of figure interpretation: wind is blowing from the north 10.6% of the time.

Round Mountain Mine

Figure 3-26

Windrose
North Site - Period 1993





WIND SPEED CLASS BOUNDARIES
(Miles/Hour)

Notes: Diagram is of the frequency of occurrence for each wind direction.
Wind direction is the direction from which the wind is blowing.
General example of figure interpretation: wind is blowing from the north 14.3% of the time.

Round Mountain Mine

Figure 3-27

Windrose
South Site - Period 1993

Estimates of atmospheric stability from 1993 on-site observations indicate approximately 27 percent unstable conditions, 52 percent neutral conditions, and 21 percent stable conditions. The relatively high average wind speeds on the site contribute to the increased frequency of neutral conditions.

3.9.1.4 Air Quality

Table 3-31 gives the estimated emissions from current operations at the Round Mountain Mine site. The particulate matter emissions are approximately 2.3 tons per day or 790 tons per year. Most of these emissions (almost 90 percent) are fugitive dust from mining activities, such as drilling, blasting, ore/waste removal and dumping, and haul truck traffic on unpaved roads. Data for ambient concentrations of inhalable particulate matter were collected near the project site for 1993 and 1994. Three samplers were used, two co-located at the north site (samplers 1S and 1N), with a third at the south site (sampler 2). All samplers were mounted on 6-foot high platforms. The samplers were run for 24 hours every sixth day following EPA's standard data collection schedule.

TABLE 3-31
Summary of Existing
Round Mountain Mine Site
Particulate Matter Emissions

Component	Controlled Max. Daily Emissions (pounds/day)	Controlled Max. Annual Emissions (tons/year)
Mining Operations	4,020	695
Diesel Fuel Combustion	473	82
South Crushing Plant	102	13
Total	4,595	790

Table 3-32 summarizes particulate matter concentrations collected during 1993-94 at the Round Mountain sites. The maximum 24-hour value during this period was 114 micrograms per cubic meter, which is less than the Nevada state and federal 24-hour particulate standards of 150 micrograms per cubic meter. The maximum annual value, based on the arithmetic average of all 1993 samples, was 28 micrograms per cubic meter, which is less than the Nevada and federal annual arithmetic particulate matter standard of 50 micrograms per cubic meter.

Measured concentrations of particulate matter were highest at the north site, which is located nearest to the emissions from mining activities.

The influence of Round Mountain Mine site emissions is not seen in the south site particulate matter measurements, demonstrating that air quality impacts surrounding mining operations tend to be highly localized.

3.9.2 Environmental Consequences

Impacts to air quality were judged against the National Ambient Air Quality Standards. These standards represent the maximum air concentrations of a given pollutant determined to have no detrimental impacts on public health and/or the environment. National Ambient Air Quality Standards levels are also recognized by the State of Nevada.

The National Ambient Air Quality Standards for particulate matter are illustrated in ***Table 3-33***.

TABLE 3-32
Summary of Particulate Matter Measurements at the
Round Mountain Mine

Site	Maximum		2nd Maximum		Annual Average		No. of Samples	
	1993	1994	1993	1994	1993	1994	1993	1994
North (1S)	84	113	55	74	19	24	59	58
North (1N)	107	114	66	76	22	28	56	56
South (2)	31	45	23	39	10	13	61	55

Note: Concentrations are in micrograms per cubic meter.

TABLE 3-33
Ambient Air Quality Standards
for Particulate Matter

Time Period	Nat'l. Ambient Air Qual. Standards
24-Hour	150
Annual Mean	50

Note: Concentrations in micrograms per cubic meter

Particulate matter is the regulated pollutant of concern and represents the fraction of particulate matter sized below 10 microns in diameter (1 micron equals 10^{-6} meters, or approximately 0.00004 inch). Particulate matter less than 10 microns in size can be inhaled into the lungs, causing potentially harmful effects. The annual arithmetic mean particulate matter concentration is never to be exceeded. The 24-hour particulate matter concentration may be exceeded no more than an average of once per year over 3 years.

3.9.2.1 Proposed Action

Impacts to the air quality in the area of the proposed mill expansion are expected to be similar to the current operations. The primary pollutant is expected to be particulate matter from the addition of a primary crusher system, mill facility, and ore stockpiles. Current mining operations produce 180,000 tons of ore and overburden rock per day. Development and operation of the proposed milling facility would not significantly alter current mining operations or its impact on local and regional air quality.

The expected project particulate matter emissions from operating the proposed new facilities are summarized in ***Table 3-34***. Total emissions from the new facilities would be small, only approximately 9 pounds per day for the worst-case day and less than 2 tons annually. This increase is less than 1 percent compared to existing Round Mountain Mine site emissions (see **Table 3-31**). Particulate emissions would be controlled using baghouses and would meet regulatory limits set by the Nevada Administrative Code for industrial operations, as well as applicable federal New Source Performance Standards. Source-specific emission limits can be set by the Nevada Division of Environmental Protection in the permit for the new facilities.

Construction activities associated with the proposed modifications would also generate dust emissions. These emissions would be controlled by applying water with a dust control additive. There would also be exhaust emissions from construction equipment. These emissions would be similar in nature to the emissions from mining operations, and any impacts would be localized around the active construction areas. Construction emissions would be both short-term and temporary, and are not considered significant.

Air emissions associated with the tailings impoundment would be minimal. Occasionally, dust emissions may be generated from the tailings during windy periods when the tailings become dried. However, these events would be relatively infrequent, and any impacts from the tailings would be localized and restricted to the area immediately around the tailings. Because the tailings emissions would occur only during strong winds (maximum dilution), this would tend to diminish their impact on the environment. Because tailings emissions are infrequent, short-lived, and impact only a small area, their overall impact is not considered significant.

The air quality impacts involve the proposed new operations in conjunction with existing air emission points at the existing Round Mountain Mine. No other industrial facilities in the area interact with the air quality impacts of the Round Mountain Mine. The impact of particulate emissions from the proposed project will be regulated by the Nevada Division of Environmental Protection. The Nevada Division of Environmental Protection will review the project proposal to ensure new emissions, in association with existing emissions, do not exceed applicable regulations. The air quality permit application for the project has been filed with the Nevada Division of Environmental Protection and is still undergoing technical review.

The Nevada Division of Environmental Protection is requiring that before being issued new/modified source air permits, facilities must consolidate all existing permits. Previously, the Nevada Division of Environmental Protection issued separate permits for each emissions unit, resulting in many individual air permits at a single operation. The consolidated permit program is in preparation for the Title V Air Quality Operating Permit program authorized under the 1990 Clean Air Act Amendments. The Nevada Division of Environmental Protection's Title V permit application deadline is expected to be some time in 1996, pending EPA approval.

TABLE 3-34
Controlled Particulate Matter Emission Factors for the Round Mountain Mine Following Installation of the Proposed Facilities

Emissions Source	Source Type	Control Measure	Control Efficiency (%)	Controlled Maximum Daily Emissions (pounds/day)	Controlled Maximum Annual Emissions (tons/year)
MILL SYSTEM					
Primary Crushing	Process	Baghouse	99.9	2.40	0.44
Transfer Belts B2-B3	Process	Baghouse	99.9	2.88	0.53
Transfer Belts B3-B4	Process	Baghouse	99.9	2.88	0.53
Crusher Ore Reclaim	Process	Baghouse	99.9	0.02	0.04
Lime Silo Discharge	Process	Discharge Shroud	70.0	0.90	0.16
Lime Silo Loading	Process	Baghouse	99.9	0.02	0.04
TOTAL PARTICULATE MATTER EMISSIONS				9.10	1.67

Source: RMGC 1993c

Compliance with the Nevada Division of Environmental Protection air regulations is demonstrated using standard EPA dispersion models. EPA's Industrial Source Complex model (EPA 1992) and COMPLEX 1 model (Pierce et al. 1980, Chico and Catalano 1986) are used to make the dispersion calculations. The Industrial Source Complex model predicts impacts from sources in flat to gently rolling terrain, while COMPLEX 1 addresses impacts to location in mountainous terrain. The combination of the two models covers all of the terrain surrounding the project site.

The dispersion modeling results are used to estimate the impact from the entire Round Mountain Mine, including the proposed new facilities. Results of the dispersion modeling have been summed with background monitoring concentrations measured at the north site to estimate an overall impact. This approach yields a worst-case estimate because the impact of existing ore processing operations are represented in both the modeled impacts and background monitoring levels.

Added together, the modeling and Site 2 monitoring results provide a worst-case estimate of impacts from the existing and proposed operations. ***Table 3-35*** shows the results of the impact analysis for the Round Mountain expansion. As can be seen, the total impact would be considerably less than the Nevada and federal standards for particulate matter.

Fugitive dust from mining operations is not included in the modeling, following present Nevada Division of Environmental Protection practice. However, the impact of mining operations is represented in the monitored background data.

In December 1992, the SVCO ceased operating the north crushing facility, which has since been removed and salvaged. The increased emissions from the proposed expansion evaluated here is offset by the decrease in emissions from closing the north crushing facility, so that a substantial decrease in emissions has occurred since 1992. The emissions decrease is primarily attributable to the use of more modern and efficient particulate emission controls on newer crushing equipment.

3.9.2.2 Range Management Alternative

Air emissions associated with this alternative would be similar to the proposed action and would not be considered significant.

3.9.2.3 Tailings Impoundment Alternative

Air emissions associated with the alternative tailings impoundment are very small. Relocating the tailings impoundment to the north would have

TABLE 3-35
Maximum Cumulative Particulate Matter Impacts for the Round Mountain Mine Expansion

Averaging Period	Maximum Modeled Concentration	Monitored Concentration	Total Impact	Nevada Standard	Federal Standard
24-hour	14.4	114.0[1]	128.4	150.0	150.0
Annual	0.6	28.0[1]	28.6	50.0	50.0

[1]1994 data for Site 1N.
Note: All values are given in micrograms per cubic meter.
Source: RMGC 1993c

an insignificant effect, and the overall impacts would be similar to the proposed action.

3.9.2.4 No Action Alternative

Selection of the no action alternative would eliminate the small emissions increase associated with the proposed action and the resultant incremental increase in ambient air concentrations near the project site. However, the emissions associated with the proposed action are quite small compared to existing emission levels at the Round Mountain Mine site. Therefore, selection of the no action alternative would produce no significant changes compared to the proposed action.

3.9.3 Cumulative Impacts

Cumulative impacts to air quality potentially include impacts from existing Round Mountain Mine emission sources and mining operations, impacts from the proposed expansion/modification, impacts from nearby existing/proposed industrial or mining operations, and impacts from background emission sources (e.g., natural background from windblown dust and public traffic on unpaved roads in the region).

As stated previously, air impacts from mining operations tend to be localized in the vicinity of the source. The geographic extent of impacts is therefore small. Even nearby operations would have only limited overlap with impacts from the Round Mountain Mine site. Since the Round Mountain Mine site is by far the largest air emission source in the immediate vicinity, its existing impacts dominate any cumulative impacts to air quality.

Air quality impacts associated with the potential future dedicated leach pads at the Round Mountain Mine site would be relatively minor. Since the dedicated leach pad project would be intended to replace the current reusable leach pads, most operations at the site would be unchanged. As such, air emissions and impacts would be unaffected. A possible cumulative air quality impact could be a minor increase in fugitive dust and vehicle exhaust emissions from increased truck traffic associated with this particular operation.

Also, cumulative impacts from existing operations would already be reflected in the measured particulate matter levels at the site. As shown in ***Table 3-32***, measured particulate matter levels near the project site are relatively low, indicating no significant impacts from non-Round Mountain sources in the local region. Therefore, cumulative air quality impacts from the proposed expansion/modification are not considered significant.

3.9.4 Monitoring and Mitigation Measures

As the proposed action and alternatives would result in no significant adverse effects on air quality, specification of monitoring and/or mitigation measures is unnecessary. However, the SVCO currently has an ongoing program for monitoring particulate matter levels around the existing operations. This monitoring is expected to continue as part of the mine's Nevada Division of Environmental Protection air quality permit.

3.9.5 Residual Adverse Effects

The proposed action and alternatives would produce no residual adverse effects on air quality.

3.10 Access and Land Use

3.10.1 Affected Environment

3.10.1.1 Land Ownership and Land Use Plans

Nye County encompasses approximately 18,064 square miles. Almost 95 percent of the county's land area is administered by the federal government, including BLM lands (10,555 square miles), portions of the Toiyabe and Humboldt National Forests (2,742 square miles), U.S. Department of Energy test sites, and the U.S. Department of Defense Test Range (3,593 square miles). Less than 0.1 percent of the county is state owned, leaving only slightly over 5 percent in private ownership. Ownership in the project vicinity is similar to the county as a whole, with a somewhat higher percentage of private land clustered near water sources such as wells and springs. ***Figure 2-2*** illustrates land ownership in the project vicinity. Both the Toiyabe Range on the western flank of the Big Smoky Valley and the Toquima Range to the east are elements of the Toiyabe National Forest. The valley floor comprises public land administered by the BLM and private holdings.

Land use plans in effect for the project area are (1) the 1994 Nye County Comprehensive Land Use Plan addressing private lands (effective May 3, 1994), (2) the BLM's *Tonopah Resource Area Management Framework Plan Decisions and Tonopah Grazing Environmental Impact Statement Record of Decision* (BLM 1981), and (3) the *Toiyabe National Forest Land and Resource Management Plan Record of Decision* (USDA Forest Service 1986). The BLM is currently preparing the Tonopah Resource Management Plan and EIS; upon adoption, this plan and EIS will supersede the *Tonopah Resource Area Management Framework Plan Decisions and Tonopah Grazing Environmental Impact Statement Record of Decision* (1981). All of these plans espouse a multiple use philosophy. Relevant goals and policies of Nye County's plan include:

- Accommodating mining industry growth and decline cycles in Nye County and maximizing benefits to mining companies and to Nye County communities and residents.

- Developing a Nye County conditional use permit process for new, large-scale mining operations. The conditional use permit would require the prospective mine operator to do the following:

  - Provide estimates of the construction and/or operations workforce and associated population.

  - Describe how the workforce would be accommodated with housing resources.

  - Identify the effects of the population associated with the mine on local government facilities and services, such as schools, roads, municipal sewer and water services (where appropriate), emergency response, fire protection, and other county and community services.

- Developing a conditional use permit process that requires any new mining operation to provide a description of the proposed operation and identify any potential impacts on public health and safety. An analysis prepared for a federal or state permit could be used to satisfy all or any part of this requirement.

To date, the conditional use permit process has not been approved. The ordinance is still in the review process and may or may not be approved. The final decision is not anticipated until the fall of 1995 (R. Williams 1995).

A key objective of the proposed BLM Resource Management Plan is relevant to the proposed mill and tailings facility:

- Management will provide for mineral exploration and development in those areas open to leasing or location while providing for the preservation and enhancement of fragile and unique resources, in addition to preventing undue and unnecessary degradation of the environment.

The Toiyabe National Forest Land and Resource Management Plan "emphasizes developed and dispersed recreation, high-quality wilderness, minerals, wildlife, and fire protection while maintaining livestock and wild horses at close to current levels."

Currently, there are no county land use restrictions on any of the land within the project area; it can be developed in any manner (R. Williams 1994). The County has an adopted Uniform Building Code, but

there are no mechanisms for enforcement in place at the county or community level.

3.10.1.2 Land Uses

Existing land uses in Nye County include mining, livestock grazing, agriculture, wildlife habitat, national forest recreation, Indian reservations, federal energy and defense activities, and residential and commercial activities in generally small, rural communities. Land use in the immediate project vicinity is dominated by open space, grazing, mining, some hay production, and small community and rural acreage residential uses, although mining is becoming a more prominent feature of the landscape as the SVCO expands.

The community of Round Mountain (specifically the Hadley subdivision), 2 miles west of the proposed project site, is the primary residential community for the employees at the SVCO. Hadley and Carvers provide most of the amenities essential for small community living. These amenities include a golf course, gas stations, restaurants, a general store, and miscellaneous retail establishments. The original townsite of Round Mountain has only a few remaining resident families.

Other than mining, grazing on range allotments is the highest economic use of federal lands in the Big Smoky Valley. The Smoky Allotment would be affected by the proposed development of the mill and tailings impoundment. This allotment has two permittees with a total of 4,953 active animal unit months and 645 animal unit months of elective nonuse. The allotment boundary encompasses approximately 126,976 acres. More detailed information on grazing within the project area can be found in Section 3.6, Range Resources.

Intensive agricultural use is limited by low precipitation and limited irrigation water. There is no intensively cultivated, irrigated cropland in the immediate vicinity of the proposed project, although there are some hay meadows to the north and to the southwest in the valley. No land considered prime or unique farmland occurs in the project area.

Access to the existing mine is from State Highway 376. The mine site is bordered on the north by State Highway 378. The traffic conditions on these two highways are discussed in Section 3.12, Social and Economic Values, (3.12.1.6, Transportation). There is adequate capacity and right-of-way for the current transportation system.

3.10.2 Environmental Consequences

Environmental impacts to access and land use were considered significant if the proposed action or selected alternative could result in the following:

- Incompatibility or inconsistency with land use plans, regulations, or controls adopted by local, state, or federal governments
- Changes to land use patterns that would threaten the economic viability of existing grazing or agricultural operations
- Changes affecting continuance of existing grazing permits or other authorizations, and new permits or authorizations are required

3.10.2.1 Proposed Action

Land Ownership and Land Use Plans. The proposed mill and tailings facility would be located on public land administered by the BLM. The total new surface disturbance related to the project is estimated at 757 acres, of which 250 acres would be outside the existing permit area. The SVCO would comply with all BLM regulations governing mining under the Regulations for Mining Public Lands (43 Code of Federal Regulations 3809).

The land proposed for the SVCO expansion is adjacent to the current project boundary. It has historically been used for grazing. No direct land use conflicts with existing or proposed land use plans have been identified.

The proposed project would comply with the Federal Land Policy Management Act and corresponding surface management regulations (43 Code of Federal Regulations 3809), Nye County and BLM land use policies, and land management plans for the area, which encourage continuation of existing uses, multiple use of federal lands, and development of mineral resources.

Land Uses. Land use in the Round Mountain townsite would not be adversely affected by the proposed project during construction or operations. There is adequate housing either in the Big Smoky Valley area (the Hadley subdivision and Carvers)

or Tonopah for the short-term construction workforce. The Hadley subdivision or outlying rural subdivisions also have adequate capacity to provide residential lots and permanent housing possibilities for the 43 estimated operations workers and their families.

The impact on grazing is discussed in Section 3.6, Range Resources.

Use and enjoyment of outdoor recreational resources in the project vicinity would not be adversely affected as there is currently minimal recreational use of lands proposed for disturbance, and there are ample recreation opportunities nearby on the vast acreage of public land in the region. The proposed project would not disrupt access to other public lands in the area.

Effects on developed recreation facilities in the Hadley subdivision would be minor because the potential population increase from the proposed project, which is the factor driving recreation demand, would be very small (see Section 3.12, Social and Economic Values).

Development of the proposed project would have no direct effect on land or recreation use in the Arc Dome or Alta Toquima Wilderness Areas. Slight increases in mountain recreation and wilderness use from the proposed project operations workforce would not adversely affect recreation in the area.

Access for the proposed mill and tailings facility would remain the same as the current access to the mine operation for both the construction and operations phases of the proposed project. Increased traffic is anticipated during construction because of daily commutes by the construction workforce and periodic truck deliveries of equipment and material for the proposed mill. During operations, access to the proposed project would remain the same. Impacts related to increased traffic are discussed in Section 3.12, Social and Economic Values.

3.10.2.2 Range Management Alternative

The primary impact of this alternative would be on grazing since a total of 536 acres of currently available forage would be removed, and grazing would be restricted on an additional 893 acres. No reductions in animal unit months are proposed with this alternative. The range management alternative would encourage better grazing distribution as discussed in Section 3.6, Range Resources (3.6.2.2, Range Management Alternative). This alternative also includes a proposed redistribution of lands between the Smoky Allotment and the adjoining San Antone Allotment, with corresponding adjustments in the affected grazing permits. A more thorough discussion of the effects of this alternative can be found in Section 3.6, Range Resources.

No other land use impacts are anticipated from this alternative. The above-mentioned impacts are not considered significant and would not require mitigation.

3.10.2.3 Tailings Impoundment Alternative

The primary land use impact from this alternative would be on grazing. Construction of the tailings impoundment alternative at this location would cause a loss of 439 available forage acres outside of the existing permit area.

The direct and indirect impacts to land use associated with this alternative are not considered significant.

3.10.2.4 No Action Alternative

Under the no action alternative, the SVCO would not disturb the acreage associated with the mill and tailings facilities. Access to the proposed project area would be preserved, and the existing land uses would be maintained, including grazing on the Smoky Allotment.

3.10.3 Cumulative Impacts

Mining exploration and development activities could foreseeably take place on either Forest Service or BLM administered lands. Land ownership would not change; however, existing land uses could change from grazing, agricultural, open space, and dispersed recreational uses to mining. Mining activities are ongoing and annually have limited short-term effects on a small number of acres in the public domain.

There are no direct or indirect adverse impacts to access and land use associated with the proposed

action or the alternatives. Therefore, this project would not result in cumulative access and land use impacts.

3.10.4 Monitoring and Mitigation Measures

Land use mitigation relates primarily to range management. Section 3.6, Range Resources, discusses potential mitigation measures that could be implemented to alleviate problems associated with grazing distribution. No other access or land use impacts would require monitoring or mitigation measures. Upon project completion, the mill and tailings impoundment would be reclaimed and eventually returned to their former land uses.

3.10.5 Residual Adverse Effects

Residual land use impacts relate primarily to the success of the reclamation efforts. If, upon project completion, the affected land area were reclaimed such that former land uses were reinstated, residual adverse effects would be minimal. However, if reclamation were unsuccessful, residual adverse land use effects could occur.

3.11 Recreation and Wilderness

3.11.1 Affected Environment

Outdoor recreation opportunities are plentiful in Nye County, and are largely oriented toward the county's vast expanse of publicly owned land. Major activities include hunting, hiking, horseback riding, off-road vehicle touring, camping, sightseeing, rock hounding, and viewing historical sites.

Hunting, fishing, horseback riding, hiking, picnicking, viewing historical sites, camping, and off-road vehicle use are popular activities in the surrounding wilderness areas, mountain ranges, and BLM lands accessible from Round Mountain. The region also includes many historical ghost towns, such as Belmont and Manhattan. According to the Forest Service, recreation in the Arc Dome Wilderness is primarily horseback riding or hiking, while recreation in the Alta Toquima Wilderness is primarily hiking (Mink 1994).

Three wilderness areas designated in December 1989 in the Nevada Wilderness Bill are within approximately 25 miles of the Round Mountain Mine. A total of 38,000 acres was designated as the Alta Toquima Wilderness, 115,000 acres as the Arc Dome Wilderness, and 98,000 as the Table Mountain Wilderness. The Alta Toquima Wilderness is roughly 5 miles directly northeast of the Round Mountain Mine, the Arc Dome Wilderness is approximately 7.5 miles directly northwest, and the Table Mountain Wilderness is approximately 19.5 miles directly east. These areas are in the Toiyabe National Forest and are managed by the Tonopah Ranger District (Planning Information Corporation 1993a).

Access to the Toquima Range and Alta Toquima Wilderness is primarily from the east side of the range in Monitor Valley. Access to the Toiyabe Range and Arc Dome Wilderness is primarily from the west side of the range in Ione Valley or the southern portion of the Big Smoky Valley. The percentage of users entering these areas from six access points is presented in ***Table 3-36***.

TABLE 3-36
Users Entering the Toiyabe Range and the Arc Dome Wilderness Area

Access Point	Percent of All Users Entering Areas
Cow Canyon	40
Twin Canyon	20
Peavine Canyon	20
Jett Canyon	20
Pablo Canyon	
Wall Canyon	

Source: Mink 1994

It is anticipated that use of the Alta Toquima Wilderness and Arc Dome Wilderness will increase in the coming years as more people from urban areas discover these low-use wilderness areas. Currently, most of the visitors are from Reno, Las Vegas, and California (Mink 1994). Residents of the Big Smoky Valley/Round Mountain area access the two mountain ranges primarily from Wall, Pablo, and Jett Canyons on the east side of the Arc Dome Wilderness, and Morris Creek, Shoshone, and Jefferson canyons on the west side of the Alta Toquima Wilderness. Local residents also cut wood near Willow Springs in the southern portion of the Toquima Range, approximately 8 miles south of State Highway 377.

According to the Nevada Division of Wildlife, big and small game hunting pressure in the Toiyabe and Toquima Ranges is low (Lusk 1994a). This low pressure is partially caused by limited access from the Big Smoky Valley to the hunting areas and also to the limited wildlife values in the area. It does not appear that the expanded population in the Round Mountain area or designation of the two wilderness areas has increased demand for hunting licenses. Some bighorn sheep and deer hunting does occur; however, only four bighorn tags are available for the Toquima Range and one bighorn tag for the Toiyabe Range. The number of hunting licenses has remained fairly constant year after year. The Division of Wildlife does not have any hunting or fishing statistics specific to the project area.

TABLE 3-37
Developed Campsites in Project Vicinity

Site	Location	Number of Units	Group Units	Season of Use
Pine Creek	East side Alta Toquima Wilderness	21	1	5/1 - 10/15
Peavine	16 miles south of Round Mountain	10	1	5/1 - 10/30
Carvers (State operated)	7 miles north of Round Mountain	6	0	1/1 - 12/31

Source: Mink 1994

There are few developed campsites within the Tonopah Ranger District close to the proposed project site. Developed campsites are shown in ***Table 3-37.*** Other undeveloped camping areas used by the existing population include Wall Canyon and South Twin in the Toiyabe Range; and Mariposa, Shoshone Canyon, Jefferson Canyon, and Jefferson townsite in the Toquima Range. Open BLM land is also frequently used for camping.

Some of the current recreation concerns in the Toiyabe National Forest include frequent violation of three- and four-wheel off-road vehicles in the wilderness areas and excessive trash left in the wilderness areas. Recently, the Toiyabe National Forest hired an additional seasonal worker to patrol the wilderness and pick up trash (Mink 1994).

There are no BLM wilderness study areas in proximity to the proposed project. Recreational uses on BLM land in the project area are primarily sightseeing, rockhounding, hunting (chukar, dove, grouse), and off-road vehicle use.

The BLM Tonopah Resource Area has an estimated 6,091,101 acres of land. The BLM estimated annual visitor use in the area for Fiscal Year 1993 is shown in ***Table 3-38***.

Developed recreational facilities are available in the Round Mountain area and Tonopah. Recreational facilities in the Hadley subdivision include a park, ballfield, golf course, swimming pool, tennis courts, and gym. Recreational facilities at the original Round Mountain townsite include a small park, ballfield, track, and gym. Tonopah has a variety of recreational facilities, including several parks, a swimming pool, the Central Nevada Museum, the Joel Friel Sports Complex, a golf driving range, a rodeo arena and fairgrounds, tennis courts, and ballfields. See Section 3.12, Social and Economic Values, for additional information on developed recreation facilities in the area.

3.11.2 Environmental Consequences

Environmental impacts to recreation and wilderness would be significant if:

- Total recreation demand in the area increased by 10 percent or more over baseline conditions
- Developed recreational facilities, state of national parks, or wildlife refuges have 5 percent or more of their land area permanently altered
- The quality of recreational activities decreases because of decreases in access, game population, aesthetic experience, increased demand, or another reason

TABLE 3-38
Annual Visitor Use
BLM - Tonopah Resource Area

Recreation Type	Participants
Off-Road Vehicle Travel	7,200
Other Motorized	73,000
Non-Motorized	1,000
Camping	2,000
Hunting	1,500
Site Based	75,000
Fishing	1,000
Winter Sports	3,000
Total Participants	**163,700**

Source: BLM 1993a

3.11.2.1 Proposed Action

Use and enjoyment of outdoor recreational resources in the proposed project vicinity would not be adversely affected as there is minimal, if any, recreational use of the lands proposed for disturbance, and there are ample recreational opportunities nearby on the vast acreage of publicly owned land in the region. The proposed project would not disrupt access to other public lands in the area.

Effects on developed recreational facilities in Round Mountain/Hadley would be minor because the potential population increase from the proposed project, which is the factor driving recreation demand, would be small (see Section 3.12, Social and Economic Values).

Development of the proposed project would have no direct effect on Arc Dome or Alta Toquima Wilderness Areas. Visual and noise impacts in the Toquima and Toiyabe Ranges and Arc Dome and Alta Toquima Wilderness Areas would not affect the quality of primitive wilderness experiences.

Slight increases in mountain recreation and wilderness use from the proposed project operations workers and their families would not adversely affect recreation in the project area.

3.11.2.2 Range Management Alternative

The range management alternative would have no impact on recreation or wilderness activities within the project area.

3.11.2.3 Tailings Impoundment Alternative

The tailings impoundment alternative would have no impact on recreation or wilderness activities within the project area.

3.11.2.4 No Action Alternative

Under the no action alternative, the acreage associated with the proposed mill and tailings facilities would not be disturbed. The slight increases in recreation activities in the wilderness areas or National Forest from proposed project employees would not occur.

3.11.3 Cumulative Impacts

The majority of recreational activities, such as horseback riding, camping, and hiking, occur mainly in the Toiyabe and Toquima Ranges. Foreseeable cumulative projects within the Big Smoky Valley would impact only a small number of acres annually in these areas; cumulative impacts to recreation and wilderness are not anticipated.

3.11.4 Monitoring and Mitigation Measures

No significant impacts have been identified; therefore, there are no monitoring or mitigation measures recommended for recreation and wilderness resources.

3.11.5 Residual Adverse Effects

No residual adverse effects are anticipated for recreation and wilderness resources.

3.12 Social and Economic Values

3.12.1 Affected Environment

The primary study area for the socioeconomic assessment is Nye County in south-central Nevada, which includes the communities of Round Mountain (i.e., the Hadley subdivision), Carvers, and Tonopah. There are no incorporated towns within the study area; therefore, all administrative functions are provided by the county government located in Tonopah and the Round Mountain Town Board. The primary governing bodies consist of the five County Commissioners who also serve as the Planning Commission. The Forest Service and the BLM also play a major administrative role in Nye County since nearly 95 percent of the 18,064-square-mile-area is under federal control.

Round Mountain, including the Hadley subdivision, is considered a town in Nye County and operates with a town board. The town has a mill levy and generates ad valorem tax revenues for the school district and county. The SVCO is located within the town's taxing district.

3.12.1.1 Population and Demography

The population of the Round Mountain townsite was not estimated by the 1990 Census of Population and Housing since the town is not incorporated. However, during preparation of the Round Mountain/Smoky Valley portion of the Nye County Overall Economic Development Plan, Planning Information Corporation estimated the population in Big Smoky Valley using the number of residential electric meters benchmarked to the 1990 census population per household figure for the area (Planning Information Corporation 1993a). The Round Mountain townsite and the Hadley subdivision are part of the unincorporated area of Big Smoky Valley.

There are three census block groups relating to Big Smoky Valley (Block Numbering Area 9801, Block Groups 2 and 3, and Block Numbering Area 9802, Block Group 1). ***Table 3-39*** shows the estimated population for Big Smoky Valley, Tonopah, and Nye County between 1980 and 1993. The 1990 census population for these block groups, which includes Round Mountain, Manhattan, Carvers, northwest Tonopah, and outlying northern Big Smoky Valley, was 1,971. The third quarter 1993 estimate of population for Big Smoky Valley was 1,764 (Planning Information Corporation 1993a).

Currently, the population of Big Smoky Valley and the rest of northern Nye County is in a downward trend. Big Smoky Valley showed an estimated decline of 10.5 percent from 1990 to the third quarter of 1993 (Planning Information Corporation 1993a) (see ***Table 3-39***). Big Smoky Valley currently represents an estimated 8 percent of the total county-wide population.

The demographic composition of the Big Smoky Valley area consists primarily of permanent mine workers, ranchers, and long-term Big Smoky Valley residents; therefore, a relatively stable population is represented. The contract construction workforce varies according to construction projects.

3.12.1.2 Economy and Employment

The economy in Nye County depends largely on two basic industries: mining and military service activity associated with the Tonopah Test Range and the Nevada Test Site. Other important sectors include tourism and government. Tonopah serves as a regional center for Nye County, since it is

TABLE 3-39
Population Characteristics of the Project Area

Area	1980	1985	1990	1991	1992	1993	% Change 1980-1990	% Change 1990-1993
Round Mountain/ Big Smoky Valley	574	1,141	1,971	1,861	1,888	1,764	+243	-10.5
Tonopah	1,952	3,340	3,740	3,621	3,460	3,415	+92	-8.7
Nye County	9,048	14,250	17,781	19,973	20,783	21,886	+97	+23.0

Sources: ERT 1987, Planning Information Corporation 1993a and 1993b

located midway between Reno and Las Vegas. It is also the county seat of Nye County and provides countywide public services and facilities.

Table 3-40 shows resident employment by sector for the Big Smoky Valley and Nye County. From 1990 to 1993, Big Smoky Valley has experienced a decline in employment that is directly related to a decline in the local mining industry. The declining mining industry has also precipitated a decline in population in the area (see ***Table 3-39***). The estimated employment in 1993 was 988 (Planning Information Corporation 1993a). The mining sector is still Big Smoky Valley's largest employer (60.4 percent of total employment), followed by the services sector (14.0 percent). In Nye County, the largest employer is the services sector (52.5 percent) largely because of the number of contractors at the Nevada Test Site. Mining is the third largest employer in Nye County with an estimated 1,260 employees (14.3 percent).

There has been a fairly substantial decline in employment in both the service and mining sectors in Nye County because of the withdrawal of the Air Force's Stealth operation and the closure of several mines in the area, including the Cyprus, Candelaria, Gold Bar, and Mother Lode mines. Other sectors contributing to the employment base include the government sector with 14.7 percent of all jobs in Nye County and the trade sector with 8.8 percent of county-wide jobs.

Per capita income in Nye County was $16,309 in 1991 compared to a state average of $19,812 (U.S. Bureau of Economic Analysis 1991). Per capita income has increased an average of 6.2 percent since 1985. The lower per capita income in Nye County compared to Nevada as a whole is partially caused by the high percentage of senior citizens, particularly in southern Nye County, who are on fixed incomes; the number of farm and ranch workers with relatively low incomes; and the number of workers in Nye County with permanent residences in other counties.

The Big Smoky Valley area had the highest per capita income in the county ($19,967), according to the 1990 census information. The median household income was estimated at $46,815 for Big Smoky Valley (U.S. Bureau of Census 1990).

The Nye County unemployment rate continually fell below the state average until 1992 when the unemployment rate was 6.9 percent compared to 6.5 percent for the state. Unemployment in Nye County has increased from 5.0 in 1991 to 7.3 in 1993 (Nevada Department of Employment Security 1993). The state unemployment rate was 6.7 percent in 1993.

The Nye County unemployment rate is higher recently because of the employment changes that have occurred at the Nevada Test Site and Tonopah Test Range.

TABLE 3-40
Resident Employment by Sector: 1990-1993
Big Smoky Valley and Nye County

Employment Sector	1990		1991		1992		1993		Percent of 1993 Total		Percent Change 1990-1993	
	Big Smoky Valley	Nye[1] County	Big Smoky Valley	Nye[1] County	Big Smoky Valley	Nye[1] County	Big Smoky Valley	Nye[1] County	Big Smoky Valley	Nye[1] County	Big Smoky Valley	Nye[1] County
Farm and Ag. Services	23	269	22	241	21	114	21	127	2.1	1.4	(8.7)	(52.8)
Mining	670	1,961	590	1,639	593	1,426	597	1,260	60.4	14.3	(10.9)	(35.8)
Construction	33	338	26	288	26	211	26	252	2.6	2.9	(21.2)	(25.4)
Manufacturing	7	140	6	132	6	134	6	121	0.6	1.4	(14.3)	(13.6)
Transp. and Pub. Utils	47	68	41	65	41	164	42	155	4.3	1.8	(10.6)	(127.9)
Wholesale Trade	4	43	3	46	3	104	3	65	0.3	0.7	(25)	(51.1)
Retail Trade	57	872	51	849	51	628	52	716	5.3	8.1	(8.8)	(17.9)
Finance, Insurance, and Real Estate	39	491	35	531	35	173	35	194	3.5	2.2	(10.3)	(60.5)
Services	143	7,500	133	7,495	134	5,745	138	4,619	14.0	52.5	(3.5)	(38.4)
Government	74	1,208	67	1,208	67	1,365	68	1,287	6.9	14.7	(8.1)	(6.5)
Total	1,097	12,889	974	12,556	977	10,064	988	8,796	100.0	100.0	(9.9)	(31.7)

[1] Employment includes jobholders, self-employed persons, and proprietors of unincorporated businesses. The State 202 files do not contain proprietors or self-employed.

Sources: Planning Information Corporation 1993a and 1993b, U.S. Bureau of Economic Analysis 1990, Nevada Department of Employment Security 1993.

3.12.1.3 Housing

The Big Smoky Valley 1990 Census count of permanent housing units showed a total of 916 units in the entire area. The condition and availability of housing stock varies throughout the region. A large percentage of the homes are either mobile homes or modular homes.

The bulk of the 278 occupied residential lots in the Hadley subdivision are owned by the SVCO and leased at a minimal fee to its employees. Employees can also purchase a modular home to put on an SVCO lot. The company also owns some modular or mobile home units that it leases to employees. The Hadley subdivision has 430 sites available for development. The SVCO also has a 24-space recreational vehicle trailer park in Hadley that is primarily used during contract construction activities for contract labor, or as temporary accommodations for new employees (Kesl 1994).

The majority of the residents of Hadley are SVCO employees and their families. Employees pay $48 per month for lot rental in Hadley. The company also provides lots and housing for school teachers, contract laborers, Round Mountain townsite officials, and businesses that provide services to the mine on an ongoing basis. The rent for these lots is at market value, approximately $110 per month.

Currently, the original Round Mountain townsite has an estimated population of between 45 to 60 people (15 to 20 families). The townsite has a few remaining company employees. There are also a few recreational vehicle spaces available for rent at the original townsite.

Other permanent housing is available in small acreage rural residential subdivisions, and larger rural acreages. The Shoshone Estates and Senita Courts subdivisions, located near Carvers, have 1/3-acre to 5-acre parcels for sale at between $4,000 (without utilities) and $10,000 (with utilities) per acre.

Table 3-41 shows temporary housing accommodations in the Big Smoky Valley, including the Hadley subdivision and Carvers.

Rents range from $325 to $500 for a two bedroom apartment or mobile home. Currently, most rental apartments are occupied; however, these units are typically occupied on a short-term basis to temporary employees at the mine or contract construction workers (Stonier 1994). Recreational vehicle spaces rent for $105 per month for a single-wide, including water, sewer, and trash. The C & H Mobile Home Park had 70 vacancies as of April 15, 1994 (Hoops 1994). Motel rooms at the Jumping Jack Motel rent for $25 per night for two adults. The owner of the motel also has 15 rooms in a mobile mancamp, which would be made available for the construction work force. The mancamp units will probably rent for between $20 and $25 per night depending on how often maid service is provided (Berg 1994).

Some of the rental property owners surveyed suggested that additional units could be made available depending on the economic viability of bringing new units into the area; this would depend on the length of the construction period (Berg 1994). In addition, the SVCO indicated that additional recreational vehicle spaces (125) could be made available in Hadley if all other rental property and recreational vehicle spaces are occupied within the Big Smoky Valley (Kesl 1994).

In addition to the housing accommodations in Big Smoky Valley, there is an abundance of motel/hotels in the Tonopah area, which is within a 1-hour drive of Round Mountain. Currently, there are over 700 motel units in the Tonopah area.

3.12.1.4 Community Facilities and Services

Public Utilities. Residential water and sewer services in Round Mountain and Big Smoky Valley are primarily provided by individual wells and septic systems. Within the Hadley subdivision, a private water and sewer system is provided by the SVCO. The mine has three wells: one for the golf course and two for the town. The wells together can pump an average of 5,000 gallons per minute. Only 25 to 30 percent of the capacity is in use. There are also two storage tanks with a capacity of 2 million gallons. The sewage treatment system in Hadley has a design capacity of 160,000 gallons per day; the current use is approximately 30-35,000 gallons per day, or 19 to 22 percent of design capacity. The water and sewer systems were both designed to accommodate a total of 500 homesites; currently, there are 278 occupied lots in the Hadley subdivision.

The original Round Mountain townsite has one well and two springs, with the springs providing the

TABLE 3-41
Temporary Housing Accommodations
Big Smoky Valley

Apartments/Motels	Units/Bedrooms
Carvers	
Jumping Jack Motel	17
Berg Mancamp	15
Berg Apartments	8/2
Stonier Apartments	1/1
	1/3
	4/2
Baird Apartments	4/2
TOTAL	50/10
Recreational Vehicle Parks	**Spaces**
Carvers	
C&H Mobile Home Park	120
Round Mountain	
Manley Mobile Homes	3
Hadley Mobile Home Park	24
TOTAL	155

Source: Kathol & Company Telephone Survey 1994

majority of the water. All sewage treatment in the townsite is provided by individual septic systems.

Solid waste disposal is provided at the landfill 5 miles north of Round Mountain. The landfill is operated by Nye County on an 80-acre lease with the BLM. The county is currently renewing its lease with the BLM and will have capacity for an additional 20 years (Wickenden 1994). The county is also required to put in a monitoring well within the next 2 years to ensure that the landfill is conforming to EPA standards.

Electricity is provided to the communities in Big Smoky Valley by Sierra Pacific Power Company. Telephone service is provided by Nevada Bell.

Public Safety. Law enforcement is provided by the Nye County Sheriff's Department. Calls are dispatched from Tonopah to the Hadley substation where three officers provide patrol duties from 7:00 a.m. to 2:00 a.m. There are also three auxiliary volunteer law enforcement assistants on call. A mutual aid agreement with Lander and Nye Counties exists in case emergency reinforcements are needed. The Nye County Sheriff's Department has a service area of approximately 600 square miles (Eastley 1994).

Fire protection is provided by the Round Mountain Fire Department, which has 19 volunteers and one paid fire chief. The service area of the department is the Round Mountain townsite, including the Hadley subdivision. A fire rescue unit handles all motor vehicle accidents on approximately 70 miles of state and county roads within the agency's service area boundaries. The fire department has an informal agreement with the SVCO to provide emergency assistance when needed.

Fire and ambulance services are dispatched out of the Round Mountain security building in Hadley. All fire equipment is in good condition and more than adequate to serve the existing service area (Planning Information Corporation 1993a).

The Nye County Ambulance Service is located in Carvers and comprises an all volunteer service force of approximately 22 personnel. All personnel are emergency medical technician (EMT)-certified, and ten have EMT II certification. Funding for the ambulance service, including EMT salaries, comes from the Nye County annual budget (Planning Information Corporation 1993a). The SVCO also contributes some funding for special equipment when needed. The service also has informal mutual aid agreements with Lander County.

The SVCO operates two additional ambulances and a four-wheel-drive Wheelcoach for climbing steep mountain terrain. These vehicles are all intended primarily for mine employees but are available for the public upon request.

Medical services in the Big Smoky Valley area are provided by the Smoky Valley Outpatient Clinic, which is owned and operated by the SVCO. Health care services are open to the public 4 days a week, 10 hours per day, with some special time reserved for employees. Medics are on call 24 hours a day, 7 days a week.

The clinic is housed in an 1,800-square-foot building located near the Administration Building at the mine site. The staff consists of a physician assistant, a medical assistant, and a medical clerk; all have Emergency Medical Technician II training. A doctor from Nye Regional Medical Center in Tonopah visits the Round Mountain clinic weekly and supervises these operations (Planning Information Corporation 1993a).

Cultural and Recreational Services. Cultural and recreational services are provided/administered by Round Mountain. The Round Mountain Parks and Recreation Department operates the town's recreational facility located in the Hadley Center, which includes an indoor pool and water slide. This facility is owned and leased to the town by the SVCO. The Community Center is an 800-foot gymnasium and library substation, which is located in the original Round Mountain townsite. The town park contains a lighted softball diamond, a little league diamond, tennis courts, a playground area, a covered pavilion, volleyball courts, a skating rink, and a picnic area.

The town has a 5,000-square-foot main library constructed in 1990. Currently the staff at the library includes a librarian and two assistants. A library district has been formed to fund, operate, and maintain the library.

Education. The Nye County Unified School District is headquartered in Tonopah. The district operates the elementary and junior/senior high school in the Hadley subdivision.

A new elementary school site has been constructed in Hadley. The 11 modular units at the elementary school in the Round Mountain townsite were moved to the new site. The SVCO provided the land, site work, and one new modular unit for the new school. The school district purchased four additional modular units for the elementary school. The current enrollment at the elementary school is 240 for grades kindergarten through 6.

The Round Mountain junior-senior high school has an enrollment of 187. The maximum capacity of the school is between 250 and 300. According to the principal at the junior senior/high school, the facility is not adequate for the anticipated increased enrollment in the next 2 years. The school will be losing fewer graduating seniors than it gains in incoming 7th graders (Morgan 1994). The graduating class has 15 students, compared to 39 incoming 6th graders; the junior class has 23 students, compared to 41 5th graders. The request for two new teachers and an additional classroom to handle the increase in new 7th graders were both denied by the school board because of the low student-teacher ratio of 16:1, compared to the state standard of 22:1. Other facility needs include updating and increasing the number of computers and adding equipment in the vocational and home economics programs (Morgan 1994).

Table 3-42 shows current and historic enrollment for the Round Mountain elementary and junior-senior high schools.

TABLE 3-42
School Enrollment 1991 Through April 1994

School	Grades	1990-91	1991-92	1992-93	1993-94
Round Mountain Elementary	K-6	252	266	243	246
Round Mountain Jr/Sr High	7-12	139	139	167	184
Total Enrollment	K-12	391	405	410	430

Note: In the 1990-91 and 1991-92 school years, there was not a 12th grade at the jr/sr high school. Prior to the construction of the jr/sr high school, children were bused to Tonopah.
Source: Morgan 1994

3.12.1.5 Public Finance

Financial resources of the study area refer to government revenue sources and expenditures in Nye County and the community of Round Mountain. These financial statistics are important in helping to determine the fiscal impacts of industrial development on local government jurisdictions.

Property taxes county-wide were expected to total $6.8 million in fiscal year 1992-1993, which accounts for more than 32.6 percent of the county-wide revenue. Mining dominates the county ad valorem tax base through the net proceeds tax, which is expected to account for approximately $2.2 million in property taxes in 1992-93. Net proceeds from mines has grown from 11 percent of the Nye County ad valorem tax base in fiscal year 1987-88 to 33 percent in fiscal year 1992-93. Assessed valuation in the county has increased by 81 percent since 1987 because of mining activity. In Round Mountain, assessed valuation has increased by 242 percent since 1987. ***Table 3-43*** shows assessed valuation for Nye County and the town of Round Mountain from 1987 through 1993.

All communities within Nye County pay the same state, county, and school district rates for ad valorem taxes. There are additional rates levied for communities with special districts and indebtedness. The Round Mountain overall tax rate was 3.6082, which generated property tax revenues of approximately $4.5 million in 1992-93. The tax rate for the town of Round Mountain is 0.8996, which generated approximately $1.1 million for the town in 1992-93. The current rate is 3.64, and 0.8077, respectively; this rate will change for 1994-95 to reflect the creation of the Big Smoky Valley library district. The overall tax rate will remain at 3.64, the legal limit, but the town tax will be reduced to 0.7015.

The overall Nye County total tax rate within the hospital district is 2.7086, which generates property taxes of over $17 million. The county share of tax revenues is based on a 1.0761 tax rate, which generates revenues of over $6 million for the county. Other county-wide revenues include sales tax, motor vehicle fuel taxes, road tax, and payments in lieu of taxes.

Tables 3-44 and ***3-45*** show revenues and expenditures for the town of Round Mountain for fiscal years 1991 through 1993. As shown in ***Table 3-44***, total revenues for fiscal year 1993 for the town of Round Mountain totaled almost $3.3 million. Over 19 percent of the funds came from net proceeds of mines, with another 15 percent from property taxes. The town receives a fairly small share of state shared revenues (Supplemental City-County Relief Tax),—less than 3 percent.

Table 3-45 shows town expenditures for fiscal years 1991 through 1993. The greatest expenditures in the General Fund have occurred in the area of culture and recreation, which includes operating the library, Ingvart Christensen pool, and parks programming and maintenance. Over 13 percent of the General Fund budget is spent on these activities. General government activities account for the next largest expenditure outlay of the General Fund. The Capital Projects Fund also represents a large expenditure outlay. Construction of the community center and teen center will increase expenditures in this area for the next couple of years.

3.12.1.6 Transportation

The transportation system in Nye County is predominantly automobile oriented, relying almost exclusively on public roads and highways. Nye County's 18,064 square miles are served by a

TABLE 3-43
Assessed Valuation-Nye County and Round Mountain
(thousands of dollars)

Source	Fiscal Year 1987-88	Fiscal Year 1988-89	Fiscal Year 1989-90	Fiscal Year 1990-91	Fiscal Year 1991-92	Fiscal Year 1992-93
Round Mountain	36,526	35,445	42,799	89,431	94,075	125,037
Nye County	347,552	418,738	454,343	551,846	584,661	628,851

Source: Planning Information Corporation 1993b

TABLE 3-44
Round Mountain Revenues
for Fiscal Years 1991-1993

Source	Total Revenues					
	Fiscal Year 1991	Percent	Fiscal Year 1992	Percent	Fiscal Year 1993	Percent
General Fund:						
Property Taxes	$604,046	25.8	$438,183	18.8	$494,771	15.0
Net Proceeds	$188,118	8.0	$404,543	17.4	$630,063	19.1
Licenses and Permits	$1,500	0.1	$3,000	0.1	$3,000	0.1
Intergovernmental Resources						
State Shared Revenues						
SCCRT	$131,883	5.6	$89,877	3.9	$93,875	2.8
MVPT	$13,276	0.6	$27,766	1.2	$25,843	.8
Gasoline Taxes	$87,639	3.7	$32,000	1.4	0	0.0
State Library	$0	0.0	0	0.0		
Street and Highway					$34,000	1.0
Local Shared Revenues						
Nye County Schools	$0	0.0	$30,940	1.3	$26,780	0.8
Other Grant Revenue	$0					
Miscellaneous	$0		$1,000	0.1	$9,900	0.3
Charges for Services	$3,000	0.1	$17,000	0.72	0	0.0
Fines and Forfeits	$0	0.0	0	0.00		
Beginning Balance	$410,420	17.5	$320,482	13.70	$846,249	25.8
Total General Fund	$1,439,882	61.4	$1,364,791	58.6	$2,164,481	65.7
Capital Projects Fund	$785,287	33.5	$548,931	23.6	$964,887	29.3
Debt Service Fund	$121,000	5.1	$408,882	17.5	$130,412	3.9
Special Capital Projects			$7,623	0.3	$23,667	.7
Library Gift Fund					$12,000	0.4
TOTAL RESOURCES	**$2,346,169**	**100.00**	**$2,330,227**	**100**	**$3,295,447**	**100**

Source: Planning Information Corporation 1993a

3,000-mile road network, approximately one-third of which is paved (***Figure 1-1***). Round Mountain and the SVCO are located approximately 60 miles north of Tonopah on State Highway 376. State Highway 376 continues northerly an additional 50 miles and intersects U.S. 50 near Austin. The project area is served by State Highway 376, State Highway 378, and Smoky Boulevard, a paved private road into Hadley. State Highway 378 leads east from State Highway 376 to the original townsite. Smoky Boulevard leads west off of State Highway 376 into the Hadley subdivision.

State Highway 376 is a standard rural grade road with two 14-foot-wide travel lanes and a gravel shoulder. State Highway 378 is slightly wider than State Highway 376, but generally of the same grade construction and subbase. Smoky Boulevard is owned by the SVCO and is maintained by the county.

Traffic capacities for both State Highway 376 and State Highway 378 are estimated at approximately 1,800 vehicles per day. Current traffic volumes on State Highway 376 are somewhat below estimated capacity (***Table 3-46***). Levels of service on the two highways are expected to be sustained at their current "A" levels in the foreseeable future as no major changes in traffic trends are anticipated.

In addition to the highway system, there is an airstrip located in Hadley, the Tonopah Airport providing charter flying services, and a Federal Aviation Administration flight service station. There is no scheduled passenger air service in Nye County.

TABLE 3-45
Round Mountain
Expenditures for Fiscal Years 1991-1993

Function	Total Expenditures					
	Fiscal Year 1991	Percent	Fiscal Year 1992	Percent	Fiscal Year 1993	Percent
General Fund:						
General Government	$186,776	7.9	$314,720	13.5	$353,899	10.8
Public Safety	$42,015	1.8	$50,820	2.2	$90,022	2.7
Public Works	$11,000	0.5	$83,682	3.6	$23,500	0.7
Culture and Recreation	$315,794	13.5	$402,600	17.3	$443,008	13.5
Community Support	$21,972	0.5	$32,380	1.4	$16,400	0.5
Intergovernmental	$91,639	3.9	0	0.00		
Operating Transfers	$492,531	21.00	$447,010	19.2	$464,336	14.1
Ending Balance	$278,155	11.9	$33,579	1.4	$745,511	22.6
Line Item Contingency					$27,805	0.8
Total General Fund	$1,439,882	61.4	$1,364,791	58.6	$2,164,481	65.7
Capital Projects Fund	$785,287	33.5	$548,931	23.6	$964,887	29.3
Debt Service Fund	$121,000	5.1	$408,882	17.5	$130,412	3.9
Special Capital Projects			$7,623	0.3	$23,667	0.7
Library Gift Fund					$12,000	0.4
TOTAL EXPENDITURES	**$2,346,169**	**100.0**	**$2,330,227**	**100.0**	**$3,295,447**	**100.0**

Source: Planning Information Corporation 1993a

TABLE 3-46
Average Daily Traffic, State Highway 376
(1990-1992)

Location	1990	1991	1992
2 miles north of State Highway 377 (south of Round Mountain)	650	505	425
Volume/capacity ratio	0.36	0.28	0.23
3 miles north of State Highway 378 (between Round Mountain and Carvers)	1,455	1,280	1,070
Volume/capacity ratio	0.81	0.71	0.59

Source: Grauneke 1994

3.12.2 Environmental Consequences

Significance criteria that were used to analyze socioeconomic impacts of the proposed action and alternatives are listed below:

- Demand for temporary and permanent housing exceeds the existing supply when project-related needs are combined with recent occupancy rates during the scheduled construction season and operations period.
- Permanent demand on other infrastructure is greater than 10 percent of the current level of demand; construction and/or operations demand exceeds the carrying capacity in areas where workforce would live.
- The change in local tax bases is greater than 10 percent.
- The change in area population associated with the operations workforce is 10 percent or more.

- Long-term employment increases by more than 10 percent for the study area.
- Peak period traffic volume exceeds peak hour capacity on State Highway 376.

3.12.2.1 Proposed Action

This section describes the impacts of the proposed action within the context of social and economic changes in the affected area. The project-related impacts, both temporary and permanent, must also be related to changes in the overall economic picture of the area, including continued mining exploration, expansion, development, and construction of other projects.

Construction of the proposed project is scheduled to begin in early 1996 and would continue until both the tailings pond and the mill are completed (approximately one year later). The actual construction and operation schedule would depend on completion of the permitting process.

Population and Demography.

Construction. Currently, there are approximately 540 employees at the SVCO. The proposed Round Mountain mill and tailings facility is expected to have an average construction workforce of 104 people, with a peak workforce of 200 in 1996.

The effect of the expansion on the area population depends largely on the number of inmigrating workers and the demographic characteristics of their families. Population estimates for peak and average employment levels are based on a local direct workforce of between 21 and 30 people (15 to 20 percent of the overall workforce). The members of this local workforce would commute to and from their place of residence on a daily basis and would not affect population growth in the area. These workers could come from labor forces in Tonopah, Austin, Kingston, or other areas within commuting distance of Round Mountain. The non-local direct workforce is based on an estimated 83 to 170 people (80 to 85 percent of the total workforce) who would temporarily relocate to the area during construction activities.

In addition, there would be indirect employment created that would also temporarily increase the population base of Big Smoky Valley. It is anticipated that this impact would be minimal because of the limited number of retail businesses and services in the area; however, there would likely be some indirect growth in the towns of Round Mountain and Carvers given the size of the construction workforce.

With a peak non-local construction workforce of 170 workers, the peak population increase in the area is estimated at a maximum of 203 people in 1996. This represents an increase of 12 percent in the current population of Big Smoky Valley during peak construction. This is not considered significant given the short duration of the peak construction period; the peak population would remain in the area only for a short time. During this period there may be temporary impacts from increased traffic and increased police calls. Otherwise, the impacts would be generally beneficial, in the form of increased revenues to local area businesses.

The average non-local construction workforce is estimated at 83, and the average population increase is estimated at 104 based on the allocation of single and married household inmigration. This population level represents a 6 percent increase in overall population in the area. This is not considered a significant impact, particularly since the population in the Big Smoky Valley has declined in the past 4 years.

Anticipated population increases resulting from the proposed construction activity peak (203) and average construction periods (104) are summarized in ***Tables 3-47***, ***3-48*** and ***3-49***. The majority of the construction-related population is expected to locate in Big Smoky Valley, within close proximity of the mine.

Operations. Operations employment at the mine is currently 540. After completing the mill and tailings facility, the operations workforce is anticipated to increase by 43 people. Most of this permanent workforce is expected to relocate from outside the area to Big Smoky Valley. The population related to this increase is estimated at 97, and reflects both direct and indirect increases in employment opportunities in the area.

The increase in population from the operations phase of the proposed project represents a 5.5 percent increase in areawide population, which

TABLE 3-47
Employment, Population, Housing, and School-Age Children Projections
Construction Phase Average[1]

Average Employment	New Employment						
	Local Direct[2]	Non-Local Direct[2]	Total Direct	Local Indirect	Non-Local Indirect	Total Indirect[3]	Total New Employment
104	21	83	104	12	5	17	121

	New Households[4]		
	Non-Local Direct	Non-Local Indirect	New Households
New Workers	83	●	
Single	79	●	81
Married (1 worker)	4	●	7
Married (2 workers)	0	0	0
Total New Households	83	●	88

	Population and School-Age Children Big Smoky Valley
New Household Allocation[5]	88
New Population[5]	
Single Household	81
Married Household	23
Total	**104**
New School Children[6]	
Secondary	4
Primary	5
Total	**6**
Housing Preference[7]	
Mobile Home	4
Multi-Family	4
Other/Recreational Vehicle	66
Motel/Mancamp	14
Total	**88**

[1] The average construction workforce would be 104 over the 14-month construction period. The peak workforce of 200 would occur in 1996.

[2] The construction workforce is assumed to be 20 percent local, 80 percent non-local. Local workers would commute to and from their places of residence to work on a daily basis (Haas 1994).

[3] Indirect construction employment is calculated using a construction employment multiplier of 1.2 based on 1978 employment location quotients and basic/nonbasic employment. It is assumed that 70 percent of the indirect labor force is composed of second persons in the direct labor households or existing residents of the area.

[4] The construction workforce would be composed of 95 percent single workers or married without children, and 5 percent married workers with children (Haas 1994).

[5] Population estimates are based on one person per household for single households and 3.5 persons per household for married households.

[6] Eighty percent of school-age children would be primary students, 20 percent would be secondary students.

[7] Housing preferences are shown based on the following percentage distribution:

	Big Smoky Valley
Mobile Home	5%
Multi-Family	5%
Other/Recreational Vehicle	75%
Motel/Mancamp	15%

TABLE 3-48
Employment, Population, Housing, and School-Age Children Projections
Construction Phase Peak[1]

Peak Employment	New Employment						
	Local Direct[2]	Non-Local Direct[2]	Total Direct	Local Indirect	Non-Local Indirect	Total Indirect[3]	Total New Employment
200	30	170	200	12	5	17	217

	New Households[4]		
	Non-Local Direct	Non-Local Indirect	New Households
New Workers	175	5	
Single	162	2	164
Married (1 worker)	7	3	10
Married (2 workers)	1	0	1
Total New Households	170	5	175

	Population and School-Age Children		
	Big Smoky Valley	Other	Total
New Household Allocation[5]	166	9	175
New Population[6]			
Single Household	156	8	164
Married Household	37	2	39
Total	**193**	**10**	**203**
New School Children[7]			
Secondary	3	0	3
Primary	13	1	14
Total	**16**	**1**	**17**
Housing Preference[8]			
Mobile Home	8	1	9
Multi-Family	8	2	10
Other/Recreational Vehicle	125	1	126
Motel/Mancamp	25	5	30
Total	**166**	**9**	**175**

[1] The peak workforce of 200 would occur in 1996.
[2] The construction workforce is assumed to be 15 percent local, 85 percent non-local. Local workers would commute to and from their places of residence to work on a daily basis (Haas 1994).
[3] Indirect construction employment would be estimated to be the same as for the average construction workforce.
[4] The construction workforce would be composed of 95 percent single workers or married without children, and 5 percent married workers with children. Ten percent of the married households would have two people working at the mine (Haas 1994).
[5] Ninety-five percent of the workforce would live in the Big Smoky Valley area, and 5 percent would live in other areas outside the Big Smoky Valley, including Tonopah, Kingston, and Austin.
[6] Population estimates are based on one person per household for single households and 3.5 persons per household for married households.
[7] Eighty percent of school-age children would be primary students, 20 percent would be secondary students.
[8] Housing preferences are shown based on the following percentage distribution:

	Big Smoky Valley	Tonopah
Mobile Home	5%	5%
Multi-Family	5%	20%
Other/Recreations Vehicle	75%	15%
Motel/Mancamp	15%	60%

TABLE 3-49
Employment, Population, Housing, and School-Age Children Projections
Operations Phase

Average Employment	New Employment						
	Local Direct[1]	Non-Local Direct[1]	Total Direct	Local Indirect	Non-Local Indirect	Total Indirect[2]	Total New Employment
43	4	39	43	13	6	19	62

	New Households[3]		
	Non-Local Direct	Non-Local Indirect	New Households
New Workers	39	6	
Single	8	2	10
Married (1 worker)	11	3	14
Married (2 workers)	10	1	11
Total New Households	29	6	35

	Population and School-Age Children
	Big Smoky Valley
New Household Allocation[4]	35
New Population[5]	
Single Household	10
Married Household	87
Total	97
New School Children[6]	
Secondary	5
Primary	25
Total	**25**
Housing Preference[7]	
Mobile Home	31
Multi-Family	2
Single Family	2
Total	**35**

[1] The new operations workforce is assumed to be 10 percent local and 90 percent non-local. The 10 percent is based on the unskilled labor component of the operation.

[2] Indirect operations employment is calculated using an operations employment multiplier of 1.5. It is assumed that 70 percent of the indirect labor force would be composed of second persons in the direct labor households or existing residents in the area.

[3] The operations workforce would be composed of 20 percent single workers and 80 percent married workers. Dual working households would represent 33 percent of the married households (Easely 1994).

[4] During operations, it is assumed that 100 percent of the new employees would live in the Big Smoky Valley, Hadley, Carvers, or outlying rural residences close to the mine.

[5] Population estimates are based on one person per household for single households and 2.5 persons per household for married households.

[6] Eighty percent of school-age children would be primary students, 20 percent would be secondary students.

[7] Housing preferences are shown based on the following percentage distribution:

	Big Smoky Valley
Single Family	5%
Multi-Family	5%
Mobile Home	90%

would not be considered significant. ***Table 3-49*** shows the operations phase population estimate. This new population is also expected to live in close proximity to the mine, either in Hadley, Carvers, or rural residences and subdivisions throughout the Big Smoky Valley area. This population is anticipated to remain in the area for the duration of mining activity, which is projected to continue until 2008. At this time, if no additional economic activity is occurring in mining or related fields in close proximity to the town of Round Mountain, people directly or indirectly employed by the proposed project would be expected to leave the area. The loss of population at project completion would be comparable to the existing mine-related population plus the 97 estimated new operations population anticipated for the proposed mill and tailings facility.

Economy and Employment. The principal economic effect of the proposed project would be an increase in the mining sector employment in Nye County and the potential for some expanded retail and services secondary employment. Increased tax contributions would represent a positive economic benefit to the area. Tax contributions are discussed under Public Finance. The addition of between 104 and 200 direct jobs related to average and peak construction activities represents an increase of between 41 and 77 percent in construction employment in Nye County. It is estimated that between 10 and 20 percent of the construction workforce (21 to 30 employees) would be from the local area (within commuting distance). The selection of the construction contractor will determine the origin of the majority of the construction workforce.

An increase of an additional 17 indirect jobs associated with the project also provides an employment benefit to the area (see ***Table 3-47, Footnote 3***). It is assumed that even though some of the contract construction workers could commute to and from their places of residence daily, the majority of these workers would prefer to bring their recreational vehicles to the construction site for the duration of the construction period.

The addition of 43 new permanent employees would represent a 7.5 percent increase in mining employment in Big Smoky Valley and a 3.6 percent increase in mining employment county-wide. Only 4 of the total 43 workers are anticipated to come from the surrounding area, which represents the unskilled labor element of the operations workforce. Most of the new permanent workers would move to Big Smoky Valley. Employment impacts for both phases of the project are summarized on ***Tables 3-47*** through ***3-49***.

Income in the area would increase since the wage rate in the construction and mining industries is higher than other sectors of the economy. The construction base rate (average of a typical crew mix) is $16.60 per hour (Warnert 1994).The total cost per hour with overtime, taxes, benefits, subsistence, and overhead is estimated at $42.00 per hour (Warnert 1994). The range of salaries for permanent mine workers is between $13.80 and $17.40 per hour.

The average monthly payroll during construction of the proposed mill and tailings facility is estimated at $990,000, or $13.9 million for the 14 months of project construction. Annual payroll during operations for the 43 new employees is estimated at $2.3 million. A portion of this income would be spent in the local and regional area.

Assuming 85 to 90 percent (U.S. Department of Labor 1993) of these wages represent disposable income and a local spending (Nye County) capture rate of 40 percent for construction workers and 60 percent for operations employees, a total of $4.7 million in new local spending for goods and services would occur in 1996-97. An additional $1.1 million would occur annually through the life of the proposed project. Local businesses in Round Mountain and Tonopah, would benefit from this local spending. In Nye County, 2 cents per sales dollar goes to the state, 2.25 cents to the school district, and 2.25 cents to the city/county in the form of relief tax. An optional tax of .05 cent is earmarked for certain projects in Nye County. Other sales tax receipts include contractor use tax.

Housing. The demand for housing would be derived from the 88 to 175 new households created during the average and peak construction phase for both direct and indirect workers (see ***Tables 3-47*** through ***3-49***). As described in Section 3.12.1.3, Housing, the existing short-term rental housing market is generally tight. However, there appears to be an adequate number of recreational vehicle sites, apartments, mobile homes, motel rooms, and mancamp apartments in Big Smoky Valley for the proposed peak and average construction workforce. Construction workers can live within close proximity of the project in Hadley or Carvers (***Table 3-50***).

The SVCO would provide opportunities to own a home at a reasonable cost. The subdivision of Hadley has a more than adequate number of mobile home lots at a very reasonable rent of $24 per pay period for the 35 new households projected in the operations phase. There are also lots available in Carvers, Shoshone Estates, and Senita Courts. However, new operations workers would generally be required to buy or bring a mobile home or modular unit to the Big Smoky Valley area since there are few rentals and inadequate housing for sale in the area. Housing would not cause a significant impact in either the construction or operations phase of the proposed project.

Table 3-50 shows existing housing availability and project-related demand.

Community Services and Facilities.

Public Utilities. All public utilities, including water and sewer, sewage treatment, solid waste, electricity, and telephone service, would be adequate within the subdivision of Hadley and in the Carvers area for both the construction and operations phases of the proposed project. The water and sewer systems in the Hadley subdivision were designed for a capacity of 500 units each; to date, only 278 units are occupied. Rural residences are on wells and septic systems. The lease at the Round Mountain landfill is in the process of being renewed; an additional 80 acres will be added to extend the life of the landfill another 20 years.

Public Safety. Significant impacts to public safety services are not anticipated from the proposed project, although some short-term impacts on the sheriff's department during construction would likely occur. The sheriff feels that the Round Mountain station should be a 24-hour operation to serve the existing population; it currently operates from 7 a.m. to 2 a.m. (Lieseke 1994). During construction, the sheriff would like to staff the station 24-hours per day and have two extra deputies to handle the potential increase in calls caused by the construction population. As discussed in Section 3.12.1.4, Community Facilities and Services, the ambulance service feels that equipment deficiencies exist that need to be addressed; however, these deficiencies already exist and would not be caused by the project-related population.

Fire protection and medical services are adequate to serve the project-related population.

Cultural and Recreational Services. The cultural and recreational services provided by the town of Round Mountain exceed the standards typical of a town the size of Round Mountain and the service area of the Big Smoky Valley. The subdivision of Hadley has more than adequate services and facilities for the existing and future project-related population.

Education. During the construction phase, it is not anticipated that there would be many school-age children moving into the area. During peak construction, total project-related school-age children are estimated at 17; 3 secondary and 14 primary students. This would not be considered a significant impact since the elementary school has excess capacity for an additional 40 students, and the junior-senior high school has excess capacity for 60 or more students.

The anticipated impact from project-related school-age children during operations could be significant depending upon what age group is most represented. The junior-senior high will be experiencing some additional growth from the existing population in the next 2 years. This situation could be exacerbated with the new project-related population. The facility itself is large enough to handle

TABLE 3-50
Existing Housing Supply and Estimated Project-Related Impacts

	Existing Housing Supply Big Smoky Valley				Project-Related Demand	Supply/ Surplus <deficit>
	RV/Mobile Home	Apartments rms/persons	Mancamp rms/persons	Motel rms/persons		
Construction Phase						
Peak	87	16/34	15/30	17/34	175	10
Average	87	16/34	15/30	17/34	88	97
Operations Phase						
	152+	16	NA	NA	35	117

Source: Kesl, Berg, Stonier, Hoops, Manley, Baird 1994.

additional growth; however, there are not adequate classrooms to maintain an optimum classroom size, and the gym and cafeteria are in the same room, which causes scheduling problems. The additional 20 elementary students projected during operations would not have a significant impact on the new school, although a new teacher may be required depending on which grades are affected.

Public Finance. The proposed project would have a net beneficial impact on the town of Round Mountain, Nye County, and the State of Nevada fiscal condition throughout most of the life of the project. Revenue increases would result primarily from greater property, net proceeds, and sales tax revenue.

The principal revenue change for the town and county would result from an increase in assessed valuation attributable to the mine and other support facilities. The total of estimated annual capital expenditures for 1996 is $30.1 million and another $30.1 million in 1997. During operations, the SVCO would expend an additional $2.7 million in year 3, $2.3 million in year 6, and $470,000 in year 9 for tailings expansion.

Ad valorem tax (property tax) is estimated by applying the tax rate to the assessed valuation. Assessed valuation is equal to 35 percent of the capital investment. The total 1994-95 property tax rate in Round Mountain (which is distributed among the State, the school district, the county, the town itself, etc.) is 3.64. Receipt of property tax revenue on tailings and mill facility expenditures would lag 1 year behind the installation of the improvements because of conventional assessment and collection practices. The estimated ad valorem tax for the first tax collection year is $383,000 in year 1 and another $383,000 in year 2, based on a tax rate of .7015; the town's portion would be $74,000 each year. The value upon which this tax is based would normally depreciate at a rate of 1.5 percent per year for the remaining life of the project. The estimated incremental tax associated with additional capital expenditures is $34,000 in year 3, $29,000 in year 6, and $6,000 in year 9. ***Table 3-51*** shows incremental tax revenues generated from constructing the proposed tailings pond and mill.

A net proceeds tax is collected on the production of gold at property tax rates. This tax is based on estimated mining profits, which depend on gold prices in the marketplace. The incremental annual gold production from mill construction is estimated at 65,700 ounces per year over the 12-year production period. Using a market value of $380 per ounce, and assuming the cost of mining is equal to 70 percent of the value of production, the net value of 1 year's production is estimated at $7.5 million. Therefore, the net proceeds revenue is estimated at $272,000 annually based on a tax rate of 3.64.

The mine would also generate sales and use tax to the state and local governments. Because of the lack of suppliers in the local area (Nye County), no significant purchases would occur during the construction or operations phases except for diesel fuel expenditures, estimated at 30,000 gallons during construction at an average price of $1.10 per gallon. This fuel expenditure would generate approximately $1,500 in sales tax for the local economy.

The proposed project would generate an estimated construction payroll of $13.9 million during the 14 months of construction in 1996-97. If 40 percent of this amount were expended in the local Nye County economy, total estimated taxes collected would be $389,000. The new permanent workforce would be paid $2.3 million annually; assuming 60 percent of this income were spent in the local economy, an estimated $97,000 would be collected in sales tax annually. This would be considered a positive impact.

During construction and operations there may be an increase in county, town, and school district service and facility expenditures to meet the additional population demands. Typically, government entities would experience increased expenditures with little increase in revenues during the construction phase. The most significant increases in expenditure requirements would likely occur in public safety, ambulance service, schools, and community support activities. There would likely be a small financial shortfall for all government entities affected during this period.

The reverse is true during operations. Since the operations workforce is considerably smaller and more stable than the construction workforce, the demands on public services and facilities would not be significantly different than the existing demands. Nevertheless, increases in expenditures would occur for schools, public safety, and

TABLE 3-51
Incremental First Year Tax Revenues for the Proposed Tailings Impoundment and Mill Construction (thousands of dollars)

	Tailings/Mill	Tax Increment (3.64 tax rate)	Round Mountain Increment
Construction Phase			
1995 Expenditures	$30,100	$383	$74
1996 Expenditures	$30,100	$383	$74
Operations Phase			
Year 3 Expenditures	$2,700	$34	$7
Year 6 Expenditures	$2,300	$29	$6
Year 9 Expenditures	$470	$6	$1
Subtotal	$65,670	$835	
Net Proceeds Tax	$65,700[1]	$273	$52
Local Sales and Use Tax	$30	$1.50	?
TOTAL	**$65,700**	**$1,109.50**	**$214**

[1]Total estimated annual incremental gold produced from mill operation (Warnert 1994)
Source: Warnert 1994, Desiano 1994

recreational programs. In Round Mountain, the relatively small increase in population from the expanded mining operation would be more than offset by the increased revenues from property taxes and sales taxes. Also in Round Mountain, in particular, the marginal increase in population may affect the profitability of certain businesses in a positive manner. Increased population in Round Mountain is desirable from a business standpoint.

In summary, it is anticipated that the proposed project would result in public revenue surpluses to Round Mountain and Nye County. Upon completion of the project, Round Mountain and Nye County would experience reductions in ad valorem and net proceeds tax revenues equivalent to the increases experienced at the outset of the project.

Transportation. Development of the proposed mill and tailings impoundment would cause a minor increase in traffic on public roads in the area and, secondarily, would marginally increase road maintenance costs and traffic accident risks. These effects would not be considered significant.

Estimates of traffic increases were made using the population estimates developed in ***Tables 3-47, 3-48,*** and ***3-49***. The traffic analysis was conducted for the peak hour period using the peak construction employment of 200 workers and the total operations employment increase of 43 workers. The following assumptions were also made:

- All construction workers would work six 9-hour shifts per week.
- There would be three operations shifts per day with 6 workers in supervision, 13 in maintenance, and 26 in operations.
- Each worker would drive a private vehicle to work, generating one vehicle trip per worker arriving and one per worker departing.

These assumptions are considered to be very conservative; it is likely that some construction workers would carpool to and from work.

The results of the peak-hour traffic analysis are presented in ***Table 3-52.*** The proposed project would result only in moderate peak-hour traffic increases, even during the short-term peak construction activity in 1996. Level of Service A would be sustained on area highways throughout the construction and operations periods.

Traffic impacts related to truck transportation of materials and supplies for the proposed project are not yet known; however, it is assumed that truck traffic would be sporadic throughout the construction period and would be concentrated during the mill construction, but would not adversely affect traffic. Hazardous materials transport is discussed in Section 3.15, Hazardous Materials.

TABLE 3-52
Peak Hour Traffic Effects of the Proposed Mill and Tailings Facility

	State Highway 376 between SVCO and Carvers	
	Peak Construction	Operations
Existing Traffic	267	267
Project-Related Increase	175	5
Total	342	272
Peak Hour Capacity	1,800	1,800
Volume Capacity Ratio	0.19	0.15
Level of Services	A	A

Notes: February 1996.
Estimated at 25 percent of 1992 average daily traffic.
Assumes one occupant per vehicle.
Does not include persons living in Hadley, since traffic counts do not include the section of highway between Hadley and State Highway 378.
Source: Grauneke 1994

Movement of any oversize or overweight loads to the site would require individual load permits from the Nevada Department of Transportation. The SVCO would comply with this state regulation, which would ensure adequate protection of public highway facilities.

There would be no project-related effects on non-roadway modes of transportation.

Increased highway maintenance requirements would be more than offset by project-generated revenues to the county. Increased traffic, particularly at the intersection of the proposed project access road with State Highway 376, would increase the risk of accidents to some degree, but there are long, unobstructed views of approaching traffic levels on the highway. Consequently, the intersection is relatively safe, and any accident risk would be minor.

3.12.2.2 Range Management Alternative

The socioeconomic impacts of the range management alternative would be the same as the proposed action.

3.12.2.3 Tailings Impoundment Alternative

The socioeconomic impacts of the tailings impoundment alternative would be the same as the proposed action.

3.12.2.4 No Action Alternative

The no action alternative would preclude the development of the proposed mill and tailings facility. Thus, both the beneficial and adverse socioeconomic impacts identified previously would not occur. The estimated workforce of 43 operations workers would not be employed within the area, adding no new employment, income, population, or revenues to the region.

The adverse impacts associated with the inmigrant population would be avoided with the no action alternative. Anticipated increases in police and sheriff calls during the construction period of the proposed project would not occur with the no action alternative.

Fiscal impacts to local governments from increased demands on public services and facilities would be avoided with the no action alternative.

The beneficial impacts of increased employment during both the 14-month construction period and the 12-year mine operations period would not occur. An estimated average of 104 jobs during the construction period and 200 direct jobs during peak construction would not be created. An estimated average 43 direct jobs during operations would not be created.

Increased incremental annual income from operations employment payroll (an estimated $2.3 million during operations) would not be generated in the local area. The associated induced beneficial economic effects of local spending by construction and operations workers would not occur.

Estimated annual property taxes of approximately $1.1 million to Nye County and other taxing jurisdictions would not occur.

3.12.3 Cumulative Impacts

Cumulative socioeconomic impacts would result from construction or operation of other projects that contribute to changes in local population, employment, housing, public services and facilities, the economy, and the transportation network. Most of the cumulative projects discussed in Section 2.5, Past, Present, and Reasonably Foreseeable Future Actions, would affect the overall socioeconomic environment of the project area, primarily in the areas of increased population and employment, increased demand for scarce temporary and permanent housing, increased income in the project area, and increased revenues generated in Nye County and the towns of Tonopah and Round Mountain.

Only the Cyprus Tonopah Copper Mine project, located just outside Tonopah, would affect the socioeconomic character of the project area. This project has a proposed construction workforce of between 50 and 75, and a permanent operations workforce of 120. The life of the project is estimated at 10 to 15 years.

If each of the projects listed in Section 2.5 occurs in a timely fashion, demand for employment could reduce the unemployment rate in the area; the previously sluggish economy would be stimulated; personal income areawide would increase because of increased employment, direct expenditures from development activity, and indirect expenditures from the employed workforce to the local area businesses; and revenues to local and state government coffers would increase from increased property, income, and sales taxes. In addition to these positive impacts, the potential influx of new population would put extra pressure on an already tight housing market. Furthermore, the population increases associated with the project construction and operations workers could affect the provision of services by the local governments.

Most of the interrelated projects would have a greater direct impact during the construction phase; however, it is difficult to identify the secondary growth effects related to developing new mining projects, and induced growth in commercial and residential activity.

The lack of more specific information regarding projected construction and operations schedules, workforce requirements, and fiscal data precludes a quantitative assessment of cumulative impacts based on existing and reasonably foreseeable projects in the affected area.

3.12.4 Monitoring and Mitigation Measures

Most of the socioeconomic impacts associated with the proposed expansion would be beneficial (increased employment and increases in property and sales taxes); therefore, only the following mitigation measure is proposed.

SEV1: There is currently a perceived shortage of classroom space in the junior-senior high school. This condition would be monitored as the new students resulting from project operations enroll at the school. If necessary, an additional modular unit could be required, depending upon the ages of the project-related student population.

3.12.5 Residual Adverse Effects

The residual effect of the project is the continued operation and expansion of the SVCO. The construction and operation of the proposed mill and tailings facilities would spur continued economic growth within the local and regional economy from increased payroll and materials and supply purchases. Following project closure, the beneficial and adverse socioeconomic impacts would cease.

3.13 Visual Resources

The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the Federal Land Policy Management Act and NEPA. The BLM Visual Resource Management system was developed to facilitate the effective discharge of that responsibility in a systematic, interdisciplinary manner. The Visual Resource Management system provides the methodology to inventory existing scenic quality; assign visual resource inventory classes based on a combination of scenic values, visual sensitivity, and viewing distances; and assign visual management objectives. Four visual resource classes have been established to (1) serve as an inventory tool portraying the relative value of existing visual resources, and (2) serve as a management tool portraying visual management objectives for the respective classified lands. Management objectives for each of the visual resource classes are listed in ***Table 3-53***. The Visual Resource Management system also includes a contrast rating procedure for evaluating the potential visual effects of a proposed project or management activity. The Visual Resource Management system provides the basic approach for evaluating the visual impacts of the proposed expansion, as well as the potential cumulative visual impacts of the proposed mill and tailings facility.

3.13.1 Affected Environment

The visual resource area of influence for the proposed project is defined as the viewshed of the project, or the area from which the project can be seen. For the proposed project, the viewshed includes an area bounded by mountain ridges on the east and west and less well defined

TABLE 3-53
Visual Resource Management Class Objectives

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic (design) elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.
Rehabilitation Areas	Areas in need of rehabilitation from a visual standpoint should be flagged during the inventory process. The level of rehabilitation will be determined through the resource management planning process by assigning the Visual Resource Management class approved for that particular area.

Source: BLM 1986

topographic rises in the Big Smoky Valley floor several miles to the north and south of the project site. The results of the inventory process were used to determine the visual management classes for lands in the project area by applying a standard matrix to combine the inventory data. Each Visual Resource Management class has specific objectives defining how the visual environment is to be managed on lands so designated (***Table 3-53***). Landscape characteristics contributing to the inventory process for the project area are described below, followed by Visual Resource Management class designations for the visual area of influence.

The proposed project is located in the Basin and Range Physiographic Province as defined by Fenneman (1931). The province is characterized by alternating valleys and low, north-south trending mountain ridges common to central Nevada.

The topography of the project vicinity is nearly flat in the bottom of the Big Smoky Valley. The existing Round Mountain Mine is nestled against the Toquima Range to the east where the irregular rounded pyramidal forms of the foothills rise up from the valley floor toward the summit of Shoshone Mountain. Elevations in the viewshed of the project site range from approximately 5,540 feet in the valley to just over 10,900 feet on top of Shoshone Mountain. Surface soils and rocks in the vicinity generally range from buff to grayish-tan hues of light-to-medium value. The project site lies against the foothills between Shoshone and Kelsey Canyons, west-northwest of Shoshone Mountain. The existing mining operation exhibits strong color contrast with its natural surroundings and moderate to strong line, landform, and surface texture contrast. The light tans and golds of the recently mined rock on dumps and leach pads are striking in late afternoon direct sunlight, standing out strongly from the natural background. They produce less contrast in morning and midday light or under overcast conditions when the light angle or intensity does not emphasize the color differences between exposed mine rock materials and background vegetation and soils.

Vegetation on the valley floor surrounding the project area is homogeneous, consisting of small shrubs and grasses. Grasses are short and typically sparse, reflecting the desert conditions of the region. Vegetation colors in the valley range from silvery gray-green to medium olive. Somewhat brighter greens are in evidence for periods in the spring, with some tans and muted gold during the drier months. Forested areas of the foothills and mountains have darker, bluer green and dark olive vegetation colors.

Structures in the visual area of influence are geometric in form, limited mainly to residences in Round Mountain, Hadley, and Carvers. These residential communities are low-lying clusters of small buildings with little vertical relief except for a few tall cottonwoods in Carvers and even fewer in Round Mountain. From the highway at a distance of 2 miles and more, the residential communities give the impression of shapes on the surface, more notable for color contrast than for any discernible structural character. There are also a few structures on the existing mine site, which, though much larger, are largely screened from public viewpoints off the site.

Under the Visual Resource Management system, 14 Scenic Quality Rating Units were identified by the BLM Battle Mountain District for the Big Smoky Valley (ERT 1987a). The units correspond to portions of the landscape displaying similar visual characteristics or qualities. Letter values—A (highest), B, or C—were assigned to each unit based on the scenic quality of the unit relative to other units in the area.

The Toiyabe Range west of the valley and the Mount Jefferson area of the Toquima Range east of the Round Mountain Mine were designated as having outstanding scenery (Class A). The alluvial area east and south of the Toiyabe Range, the alkali flat adjacent to State Highway 376, the Simpson Park Mountains, the San Antonio Mountains, the Crescent Sand Dunes, and the north and south Toquima Range were designated as having moderately high scenic value (Class B). The remainder of the Big Smoky Valley floor was designated as having common scenic quality (Class C).

A detailed technical discussion of existing visual resources in the analysis area and the process of analysis for the visual resources inventory was prepared for the Big Smoky Valley as part of the *Anaconda Nevada Moly Project Draft Environmental Impact Statement* (BLM 1980). The supporting *Visual Resources Technical Report* (ERT 1980) provided background information for this analysis and is incorporated here by reference.

Based on the scenic quality ratings, distances from viewers, and estimated viewer sensitivity, three Visual Resource Management classes (II, III, and IV) and a visual rehabilitation area were identified in the visual analysis area (***Figure 3-28***). The existing mine area and the Round Mountain townsite are located in the rehabilitation area. Designation of a visual rehabilitation area indicates the area should be managed to improve the existing visual condition. In this case, the rehabilitation area is targeted for management to the standards of Visual Resource Management Class IV, in keeping with adjoining portions of the valley floor having similar, underlying visual characteristics. Mountainous areas to the east of the project site are rated Class II commensurate with their higher scenic quality ratings.

3.13.2 Environmental Consequences

Visual impacts of the proposed project were analyzed using the procedures outlined in the *BLM Visual Contrast Rating Handbook* (BLM 1986b). Visual impacts were determined by comparing visual contrast ratings for the proposed project facilities with the Visual Resource Management class objectives for the respective management classes that would be affected (***Table 3-53***). A visual impact was considered significant if it exceeded the Visual Resource Management objective for the respective class. As noted previously, the operant management standards for the visual rehabilitation area are those defined for the Class IV objective.

3.13.2.1 Proposed Action

Visual contrast analyses were conducted for three key observation points: (1) approximately 5 miles southwest of the mine entrance road on State Highway 376, representing travelers approaching from the south ***(Figure 3-28)***; (2) a location in Hadley near the high school, representing residents and visitors of the community ***(Figure 3-28)***; and (3) the picnic/rest area on the south edge of Carvers, representing residents of the community and travelers approaching from the north on State Highway 376 ***(Figure 3-28)***.

Development of the proposed project facilities would expand the scope of the visual contrast between existing and previously approved mine-related facilities and the natural landscape character, but would not greatly increase the visual impact from the currently approved levels. As noted in Section 3.13.1, Affected Environment, the existing mine features exhibit strong color contrast, particularly under bright, clear light conditions. In addition, there are moderate to occasionally strong line and landform contrasts generated to a large extent by the flat tops and ultimate geometric shapes of the waste rock, leach residue piles, and leach pads. Finally, there is a moderate texture contrast between the bare surfaces of the mine features and the vegetation textures and patterns in the natural landscape.

Among the various facilities of the proposed action, the only feature of notable concern from a visual standpoint is the proposed tailings impoundment. While the new mill, crusher, and ore stockpile would be sizable and potentially visually prominent in a different context, they are quite small in the context of the existing Round Mountain Mine. In addition, the proposed sites for these facilities in the interior of the project area, visually shielded by existing leach pads and waste dumps, would render them virtually indistinguishable from existing mine facilities and features. The tailings impoundment, on the other hand, is proposed for the perimeter of the site in the forefront of the viewshed as seen from the key observation points. The proposed tailings impoundment would have visual characteristics similar to existing waste dumps and leach pads, notably a geometric form and raw rock visual surfaces. Consequently, the impoundment would have similar, but expanded, visual effects to those already occurring because of the existing project: strong color contrast, moderate to strong line and landform contrast, and moderate texture contrast. The key consideration, therefore, is the degree of expansion of the visual impacts.

The existing project facilities extend approximately 3.5 miles north to south and over 3 miles east to west. An additional mile of disturbance has been approved to the south for expanding the dedicated leach pad. The existing project area has an irregular western footprint limit along the State Highway 376 frontage, which is the public frontage of the mine. The center one-third of the project area is set back approximately 1,200 feet from the highway, the northern one-third is set back more than 0.5 mile, and the southern one-third is set back at least 1 mile from the highway to the first major feature, the dedicated leach pad. The proposed project would fill in the southern frontage to approximately 1,000 feet back from the highway

Source Maps:

U. S. Geological Survey
7.5-Minute Series Topographic Quadrangles:
Pablo Canyon Ranch, NV
Round Mountain, NV
Carvers
Carvers, SE

Round Mountain Mine

Figure 3-28

BLM Visual Resource Management Classes

94028A01 XREF 28A_BASE Revision 1-4-96

to the tailings impoundment. This would double the closest frontage, extending the ultimate "wall" along State Highway 376 from its presently approved 8,000 feet to 16,000 feet (more than 3 miles). The height would be less for the proposed tailings impoundment than for the already authorized waste dumps, but the wall effect would occur, nonetheless.

The visual effect would be greatest on views from key observation point #1 because the extension would be in the immediate foreground as motorists approach from the south (see ***Figure 3-29***). The relatively low profile of the proposed tailings impoundment would help subordinate it to the higher backdrop of waste dumps backed by the even higher Toquima Range. The east-west extent of the project would not change noticeably for views from key observation point #1. Views from key observation point #2 would be only minimally affected by the proposed project (***Figure 3-30***); the apparent increase in east-west spread would be minor from this perspective 2 miles to the west. Views from key observation point #3 (***Figure 3-31***) would discern the greatest east-west expansion of the project because, from this perspective, the currently approved extension of the dedicated heap-leach pads is tucked in behind the leach residue piles. The proposed tailings impoundment would extend the east side of the disturbance area by almost 1 mile, or approximately 25 percent, albeit at the farthest point from viewers. ***Figures 3-32*** and ***3-33*** illustrate views from each key observation point after reclamation.

Without mitigation, the proposed project would have difficulty meeting the Visual Resource Management Class IV management objectives, particularly the stipulations relative to "minimizing disturbance" and "repeating basic elements (form, line, color, and texture)," despite the language that also indicates "major modification" is anticipated and that visual dominance can be accommodated in Class IV.

3.13.2.2 Range Management Alternative

This alternative would have no perceptible effect on characteristics of the visual environment beyond those of the proposed action.

3.13.2.3 Tailings Impoundment Alternative

The alternative tailings impoundment location would produce visual effects similar to those described for the proposed action, but would extend the north-south extent of the project more than 1 mile north of the existing permit boundary. This alternative would be effectively invisible to viewers from key observation point #1. It would be largely screened from key observation point #2 by the north waste dumps, but would extend the project slightly to the north. The greatest visual effect of this alternative would be on key observation point #3, which has direct views of the alternative site to the north of the existing project. The already expansive project features would be further extended by more than 1 mile to the north, the side closest to the key observation points.

3.13.2.4 No Action Alternative

The no action alternative would result in the continuation of the existing visual environment during project operations, eventually culminating in reclamation and revegetation of the project facilities.

3.13.3 Cumulative Impacts

Past and present activities are encompassed in the environmental consequences analysis, leaving only the reasonably foreseeable future actions for consideration in the cumulative assessment. Relevant future actions are focused on the SVCO future dedicated pad sites as these actions would be located within the viewshed of the proposed project. Visual effects of the pad sites would vary with location and size. The smallest pad west of the reusable pads would be essentially hidden from view by the leach residue piles. The pad site west of the north waste dumps would further extend the wall effect along State Highway 376 mentioned above, adding an additional mile to the more than 3 miles existing or proposed. While the height of the future pad is not known, the long, geometrically uniform wall effect is out of character with the natural visual character of the area. The visual contrast would be much the same as that described for other features of the proposed project: strong color contrast, stronger line and form contrast than for existing and currently proposed features, and moderate textural contrast.

3.13.4 Monitoring and Mitigation Measures

VR-1: Recommended mitigation measures after closure include varying the geometric footprint of the proposed tailings impoundment

Existing View from Key Observation Point #1 on State Highway 376

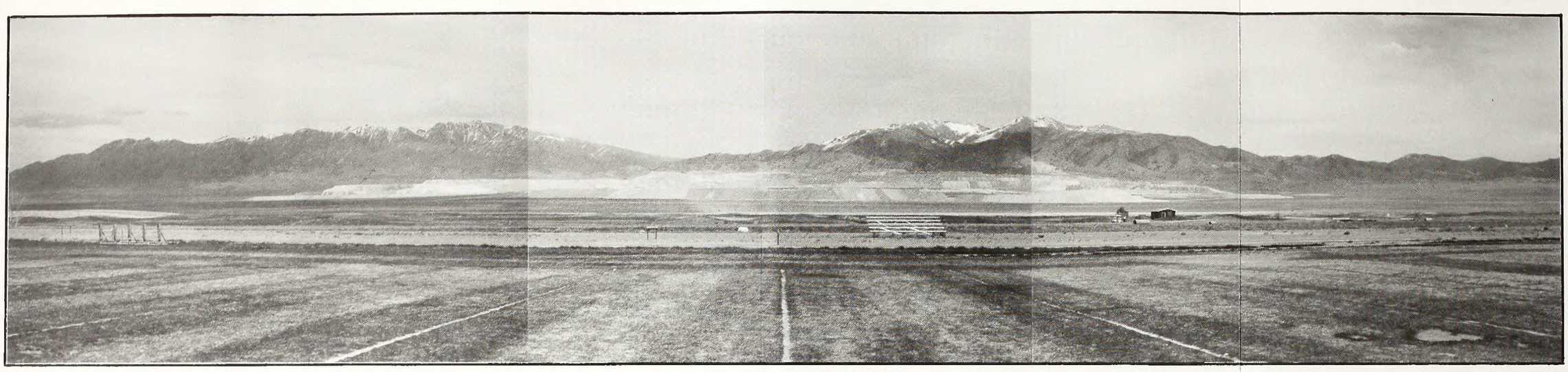
View from Key Observation Point #1 at Height of Mining

NOTE: The proposed action addresses only the tailings impoundment. All other facilities have been previously authorized.

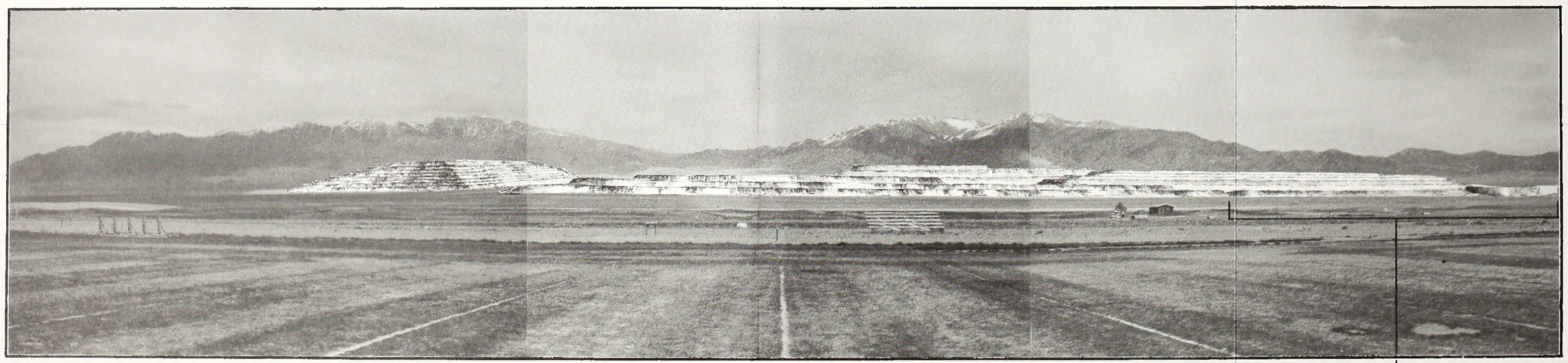
Round Mountain Mine

Figure 3-29

Views of Existing Conditions and Proposed Action - Key Observation Point #1



Existing View from Key Observation Point #2 in Hadley



View from Key Observation Point #2 at Height of Mining

Note: Bracket indicates final tailings impoundment height.

NOTE: The proposed action addresses only the tailings impoundment. All other facilities have been previously authorized.

Round Mountain Mine

Figure 3-30

Views of Existing Conditions and Proposed Action - Key Observation Point #2

Existing View from Key Observation Point #3 on State Highway 376

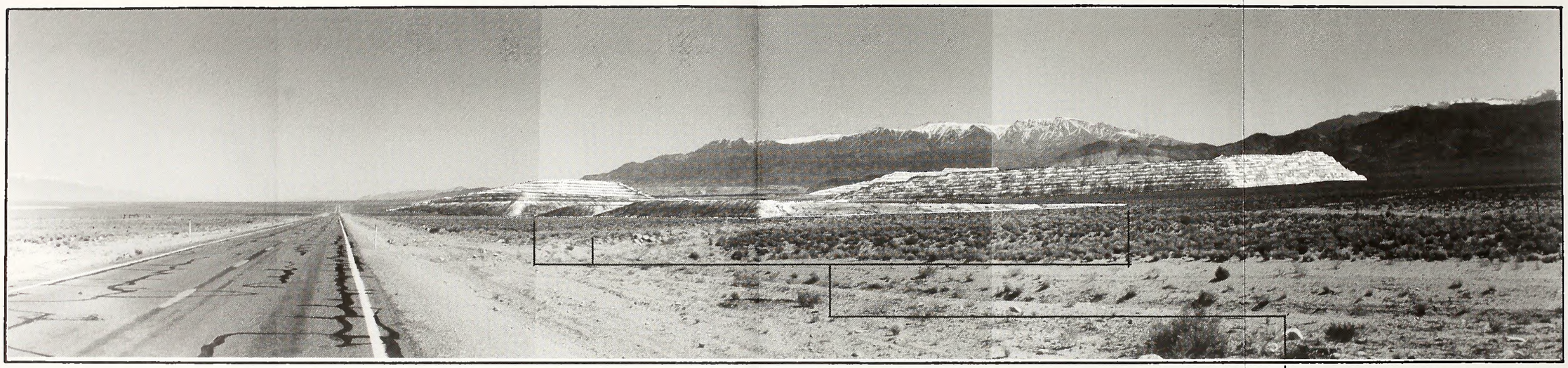
View from Key Observation Point #3 at Height of Mining

NOTE: The proposed action addresses only the tailings impoundment. All other facilities have been previously authorized.

Round Mountain Mine

Figure 3-31

Views of Existing Conditions and Proposed Action - Key Observation Point #3



View from Key Observation Point #1 After Reclamation

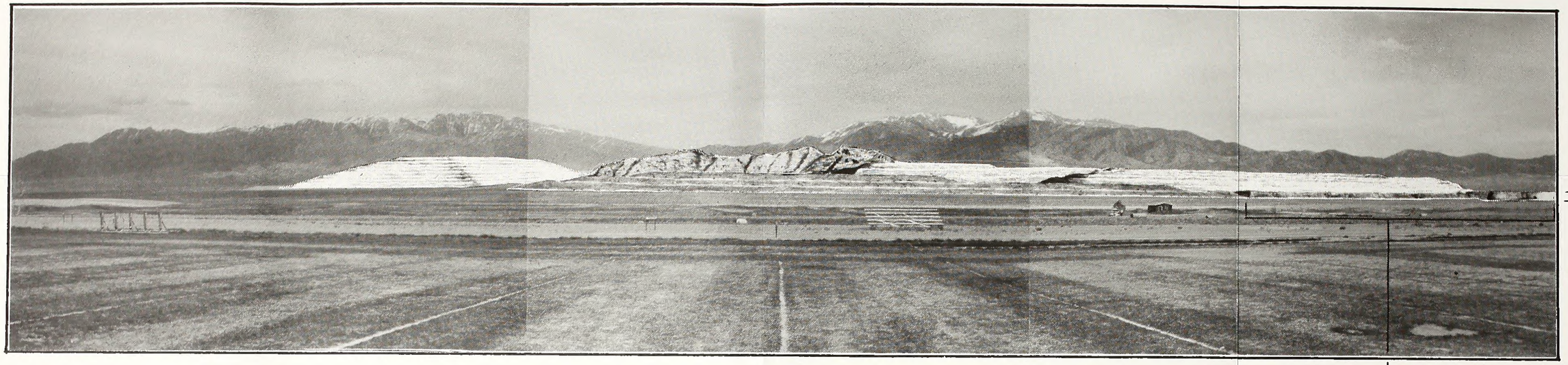
Tailings Impoundment

NOTE: The proposed action addresses only the tailings impoundment. All other facilities have been previously authorized.

Round Mountain Mine

Figure 3-32

Views from Key Observation Point #1 After Reclamation



View from Key Observation Point #2 After Reclamation

Tailings Impoundment

View from Key Observation Point #3 After Reclamation

Tailings Impoundment

Note: Bracket indicates final tailings impoundment height.

NOTE: The proposed action addresses only the tailings impoundment. All other facilities have been previously authorized.

Round Mountain Mine

Figure 3-33
Views from Key Observation Point #2 and Point #3 after Reclamation

to more nearly mimic natural lines and forms. Long, straight lines and overly simple geometric forms should be avoided with emphasis instead on horizontally and vertically irregular massing to repeat the basic elements of the natural landscape to the degree possible. The tailings impoundment faces should be regraded to more nearly match the natural slopes of the foothills and should be revegetated with native plant materials to reduce the long-term color contrast. These modifications would be implemented such that they would not affect the slope stability of the tailings.

3.13.5 Residual Adverse Effects

Residual visual effects would be similar to, but less intense than, the visual effects described for the proposed action, alternatives, and cumulative activities. The ultimate success of the visual reclamation effort depends, to some extent, on the general deposition of material and reclamation of the tailings impoundment. Revegetating the visible faces would notably reduce color contrast over the long term; regrading would reduce the form contrast. With reclamation and mitigation, the Class IV Visual Resource Management objectives should be achieved.

3.14 Noise

3.14.1 Affected Environment

The principal purpose of the noise analysis is to determine whether the proposed project would increase sound levels above the levels that currently exist in the vicinity, sometimes referred to as the ambient or background level (see ***Table 3-54*** for noise definitions). While increased sound levels are not inherently objectionable, sound becomes noise when it is unwanted or disagreeable. Noise presents a problem when it interferes with the performance or enjoyment of other activities.

Estimating the likelihood that the proposed project would cause significant adverse increases in noise levels requires that the character of the existing noise environment first be established as a baseline for the analysis. Important features of the existing noise environment include locations and types of noise-sensitive receptors, terrain features that would affect noise propagation from project-related activities, sources of existing noise near the project site, and existing ambient noise levels in the project vicinity.

Certain human activities are commonly more susceptible than others to noise interference. Such activities or land uses, termed sensitive receptors, include residential areas, schools, hospitals, libraries, and certain outdoor gathering places, such as parks, particularly when they are primarily used for passive types of recreation.

Three areas have been identified as potential noise-sensitive receptors in the vicinity of the proposed project. The two main areas are the communities of Round Mountain, on the north edge of the project site, and Hadley, approximately 2 miles west of the project site. There is also a project-provided daycare center within the site that has been identified as potentially sensitive. The Round Mountain townsite, once the primary residential community supporting the mine with an estimated 300 residences, is now much smaller as a result of the development of Hadley in the late 1980s, perhaps providing homes for as few as 15 families. The nearest residence to the mine is less than 100 yards from the proposed project site. Hadley has grown to an estimated 800 to 900 people in 200 to 300 residences; almost all families include mine-related personnel. Hadley is the location of the elementary and junior-senior high schools for the area; it also has a library, a golf course, and a few businesses. The noise-sensitive land uses in Hadley nearest the mine site are the junior-senior high school and library on the eastern edge of town approximately 2 miles from the proposed project site.

Terrain can affect noise either as a barrier or as a reflector of sound energy. Terrain acts as a barrier when an earth mound breaks the line of sight between a noise source and a receptor. The degree of effect on noise propagation depends on several factors, but projective calculations typically focus on height and continuity of the barrier. Generally, the higher the barrier projects into the line of site, the greater the noise reduction; a relatively long, continuous barrier is notably more effective than a broken barrier. The reflector effect typically occurs where a noise source is located between a raised topographic feature and a receptor. A reflector effect is generally more pronounced where the topographic incline is steep, hard surfaced, and smooth, such as a building or a flat faced rock cliff.

The topography in the vicinity of the proposed project is essentially flat on the valley floor, rising abruptly on both the east and west where the foothills begin. Within the proposed project site, the remnants of Round Mountain provide a barrier to the north, and man-made terrain barriers have grown up to the west and south as a result of the large volumes of rock moved in the mining and disposal of ore and overburden.

The elevation of the proposed project site varies from approximately 5,800[1] feet near the western boundary to just over 6,800[1] feet on the eastern boundary. (Round Mountain originally peaked at 6,894 feet but has been reduced by mining excavation.)

Existing noise sources near the proposed project are important because they influence existing noise levels and, consequently, they may affect the likelihood that project-related noise would be audible at sensitive receptors. Noise sources near the proposed project include ongoing operations at the mine itself, highway traffic on State Highway 376, overflights by military jet fighter aircraft, and natural sources such as wind, birds, and insects.

[1] Elevation is referenced to the SVCO datum, which is approximately 75 feet above the U.S. Geological Survey datum.

TABLE 3-54
Noise Terminology and Symbols

Symbol	Term	Definition
dBA	A-weighting	The most commonly used frequency-weighting measure; simulates human sound perception and correlates well with human perception of the annoying aspects of noise.
	Ambient Noise	Total, all-encompassing noise associated with a given environment and time.
	Background Noise	Noise from all sources other than a particular sound of interest (e.g., other than mining noise if mining noise was being measured).
dB	Decibel	Unit of measure of sound pressure and sound power levels. Expresses relative difference in power between two signals equal to 10 times the logarithm (base 10) of the ratio of the two levels.
Levels:		
CNEL	Community Noise Equivalent Level	L_{eq} for a 24-hour, midnight to midnight period with 5 dBA added to the sound levels from 7 p.m. to 10 p.m. and 10 dBA added to the sound levels between 10 p.m. and 7 a.m.
L_d	Day Average Sound Level	L_{eq} for the daytime period from 7 a.m. to 10 p.m.
L_{dn}	Day-Night Average Sound Level	L_{eq} for a 24-hour, midnight to midnight period with 10 dBA added to the sound levels from 10 p.m. to 7 a.m.
L_{eq}	Equivalent Continuous Sound Level	Level of steady state sound that, in a specific time period, has an equal amount of sound energy as the time-varying sound.
L_{max}	Maximum Sound Level	The greatest sound level measured on a sound level meter during a designated time interval or event using **fast** time averaging on the meter.
L_n	Night Average Sound Level	L_{eq} for the nighttime period from midnight to 7 a.m. and from 10 p.m. to midnight.
L_{pk}	Peak Sound Level	Maximum instantaneous sound level during a specified time interval or event.
L_1		Sound level exceeded 1 percent of the time during a given period.
L_{10}		Sound level exceeded 10 percent of the time during a given period; often represents a short-term noise associated with passing vehicles or airplanes flying over.
L_{50}		Sound level exceeded 50 percent of the time during a given period; the median sound level.
L_{90}		Sound level exceeded 90 percent of the time during a given period; sometimes used as an approximation for background noise.
	Noise	Unwanted sound; one that interferes with one's hearing of something; a sound that lacks agreeable musical quality or is noticeably unpleasant.

A series of noise measurements was taken in the vicinity of the proposed project to determine existing noise levels. Measurement results, illustrated in ***Table 3-55***, indicate existing noise levels in the area range from very quiet at Hadley when the wind is calm to moderate in Round Mountain when mine equipment is operating on the north waste rock dump. Noise measurements

TABLE 3-55
Ambient Noise Survey Data

Monitoring Location[1]	Date	Time[2]	Sound Pressure Levels (dBA)				Notes
			L10	L50	L90	Leq	
Round Mountain							
1A	4/16/94	22:50	39.6	38.1	39.6	36.1	Dogs, haul trucks
1A	4/16/94	13:18	43.1	43.1	37.6	45.3	
1C	4/16/94	13:42	43.1	45.6	43.1	46.9	Trucks, birds, donkey
1C	4/16/94	14:20	- - -	- - -	- - -	38.8[3]	
1C	4/16/94	14:45	- - -	- - -	- - -	35.4[3]	
1C	4/16/94	16:15	44.6	41.1	39.6	42.0	Trucks, dogs, breeze
1A	4/16/94	18:40	47.6	43.6	44.6	45.6	Trucks, birds
1C	4/16/94	21:25	44.6	41.1	38.1	41.8	Trucks
1A	4/16/94	21:50	45.6	44.6	39.6	42.7	Trucks, breeze
1C	4/16/94	22:10	- - -	- - -	- - -	32.6[3]	
1C	4/16/94	22:18	42.1	43.1	37.6	46.9	
Hadley							
2A	4/15/94	23:20	47.6	38.1	36.6	48.0	Dogs, cars, motorcycle, faint mine hum
2B	4/16/94	12:10	44.6	36.1	U[4]	40.6	Dogs, kids, cars
2B	4/16/94	15:00	40.6	39.6	31.1	37.7	Breeze, kids, cars
2B	4/16/94	15:25	- - -	- - -	- - -	30.8[3]	
2B	4/16/94	15:45	- - -	- - -	- - -	31.9[3]	
2B	4/16/94	19:25	37.6	33.1	29.6	34.7	Dogs, kids, cars
2A	4/16/94	20:05	- - -	- - -	- - -	30.8[3]	
2A	4/16/94	20:30	43.1	39.6	39.6	39.8	Dogs, people, cars
2A	4/16/94	20:05	- - -	- - -	- - -	33.2[3]	
2B	4/16/94	21:02	33.1	26.1	24.6	31.4	Dogs, people, cars; mine barely audible
2A	4/16/94	23:25	44.1	39.6	38.1	41.1	Dogs, cars; mine very faint
Child Care Center							
	4/16/94	14:36	51.1	46.6	44.6	48.3	Mine noise, light vehicle traffic
	4/16/94	22:45	52.1	50.1	48.6	50.3	
	4/16/94	23:10	- - -	- - -	- - -	42.0[3]	

[1]See text
[2]Approximate
[3]Octave band measurement
[4]Under set measurement range of instrument

were taken at three locations in Round Mountain and at two locations in Hadley. In addition, readings were taken twice at the child care center near the mine office. Round Mountain townsite monitoring was conducted primarily at the site of the former elementary school and at a location on Mariposa Avenue near the southern edge of town. A single set of readings was taken at the mine property north fence line. Hadley monitoring was conducted at the junior-senior high school parking lot and at the football field on the eastern edge of town nearest the mine.

The average equivalent continuous sound level from the Round Mountain measurements was 42.2 dBA. The day-night average sound level was 46.0 dBA. The Hadley average equivalent continuous sound level and the day-night average sound level were 39.0 dBA and 50.3 dBA, respectively. To put these readings into context, the sound levels for Round Mountain were similar to sample measurements taken in small town residential environments, while the Hadley levels were more akin to rural farm valley sample measurements (EPA 1971). In comparison, the measurements taken at

the child care center yielded an equivalent continuous sound level of 49.3 dBA and a day-night average sound level of 56.5 dBA, which is similar to urban residential measurements recorded by the EPA (1971a).

Field observations at Round Mountain indicated the noise environment was dominated by haul truck activity on the northern waste rock piles of the mine. Background levels without the trucks would have been very quiet; there was no other discernible noise coming from the mine at this location, and there was very little other activity in the community during the monitoring. Noise in Hadley was typically dominated by common community sound sources such as automobiles, occasional motorcycles, children playing, and dogs barking. There was a low-level hum from mine activity across the valley when the wind was calm, but the hum was not discernible when wind speeds were above 7 to 10 miles per hour, which is quite common in the Big Smoky Valley. Wind speed, temperature, and relative humidity measurement results are presented in ***Table 3-56***.

3.14.2 Environmental Consequences

Noise impacts are commonly judged according to two general criteria: the extent to which a project would exceed federal, state, or local noise regulations, and the estimated degree of disturbance to people. There are no specific federal, state, or local noise regulations that would govern at the project site. Consequently, the degree of disturbance becomes the key factor in evaluating the significance of noise effects; in this case, disturbance to the residents of Round Mountain and Hadley, and the SVCO child care center. Specific criteria include (1) the degree of project-related increase in average sound levels (equivalent continuous and day-night average) and (2) project-related changes in noise levels at Round Mountain and Hadley relative to the U.S. Department of Housing and Urban Development acceptable noise standard of 65 dBA (day-night average sound level) in residential areas. These quantifiable criteria are used to predict the effect of human disturbance, which is known to vary with a number of interrelated factors, including the change in noise level; the presence of other, non-project related noise sources in the vicinity; peoples' attitudes toward the project; the number of people exposed; and the type of human activity affected, for example sleep or quiet conversation as compared to physical work or active recreation.

3.14.2.1 Proposed Action

The primary source of noise from development of the proposed action would be from ore crushing. Rock and ore would be mined and distributed, but the amount of material moved would not change from existing, approved levels, so there would be no measurable change in noise from ore-handling equipment. The duration of tailings impoundment construction activity would be limited, and ongoing maintenance of the facility would generate only sporadic, minor noise emissions.

A construction equipment roster with noise emission characteristics was developed using data from a comparable tailings impoundment construction project and EPA (1971a) construction equipment noise data. The scenario assumed simultaneous use of two dozers, two scrapers, one front end loader, one rock drill, and three trucks. Peak noise emissions were estimated at approximately 102 dBA at a reference distance of 50 feet. No barriers were assumed, and atmospheric attenuation was deleted from the analysis. The overall scenario was very conservative, yielding the highest likely noise emissions at the sensitive receptors. Separate calculations were prepared for the two sections of the proposed tailings impoundment because it was assumed that they would be built serially rather than simultaneously.

TABLE 3-56
Weather Conditions During Field Noise Survey

Date	Time[1]	Temperature (F)	Wind		Relative Humidity (%)
			Speed (mph)	Direction	
4/15/94	22:50	57º	0	- -	15
4/16/94	12:00	74º	0-5	Var.	15
	13:15	76º	0-12	SE	11
	18:40	70º	0-7	SE	14
	20:30	62º	0-2	Var.	18

[1]Pacific Standard Time

The estimated noise effects were slightly higher for the northern section of the tailings impoundment because it would be closer to the receptors. Calculations indicated that peak noise levels during construction of the northern section would be slightly over 54 dBA at the eastern edge of Hadley and slightly under 55 dBA at the SVCO child care center. These levels are higher than ambient levels, measured at 32 dBA and 42 dBA, respectively, for the Hadley and child care center locations. These levels indicate that construction noise would be heard at the receptors on those occasions when a full contingent of equipment was operating at high intensity levels. Nonetheless, the noise effects estimates are not considered significant because the very conservative assumptions noted above indicate these peak levels would rarely, if ever, occur. Furthermore, the construction activity would be limited to daytime hours when people are somewhat less sensitive to noise. In addition, the estimated noise effects would not exceed the 65 dBA threshold that is considered acceptable for residential areas, even though they are measurably higher than ambient levels.

Construction noise would not be audible at the Round Mountain townsite sensitive receptors. The distance from the proposed northern section of the tailings impoundment to Round Mountain is more than a mile greater than to Hadley. The added distance combined with the intervening earth/rock barriers would effectively reduce the noise levels to well below ambient levels.

Total operational noise emissions were estimated for the proposed ore-crushing activities based on field measurements taken of the existing crushing and grinding equipment in place at the Round Mountain Mine (***Tables 3-57*** and ***3-58***). Resulting noise effects were modeled for the sensitive receptor locations (***Table 3-59***). As illustrated, project-related operational noise effects would be essentially non-existent at the Round Mountain receptors and very minimal at Hadley and at the child care center. With noise level increases of only 0.3 dBA at the eastern edge of Hadley and 0.7 dBA at the child care center, noise associated with the proposed action would not be discernible from background noise. The noise effects would not be considered significant.

3.14.2.2 Range Management Alternative

The range management alternative would have the same effect on noise levels at sensitive receptors as the proposed action.

3.14.2.3 Tailings Impoundment Alternative

Construction noise was analyzed for the tailings impoundment alternative using the same equipment and emissions scenario that was developed for the proposed tailings impoundment. Calculations indicated that peak noise levels during construction of the alternative impoundment would be slightly under 57 dBA at the Round Mountain school site and approximately 58.4 dBA at the Round Mountain residence receptor. These levels are higher than ambient levels, measured at 35.6 dBA for both receptor sites. These levels indicate that construction noise would be easily heard at the receptors on those occasions when a full contingent of equipment was operating at high intensity levels. The estimated noise levels are not considered significant because the very conservative assumptions employed in the analysis indicate these peak levels would rarely, if ever, occur, and because the construction activity would be limited to daytime hours when people are somewhat less sensitive to noise. The estimated noise levels would not exceed the 65 dBA threshold that is considered acceptable for residential areas, even though they are measurably higher than ambient levels.

3.14.2.4 No Action Alternative

Under the no action alternative, existing activities would continue at the Round Mountain Mine as they have been approved to date. From a noise perspective, the result would be essentially no change in existing ambient noise levels as measured in the field and presented above.

3.14.3 Cumulative Impacts

Present activities in the vicinity of the proposed project have been included in the ambient noise measured in the field such that they are included in the analysis of the proposed project and alternatives. The only reasonably foreseeable

TABLE 3-57
Noise Levels From Existing Crushers

Monitoring Location[1]	Date	Time[2]	Sound Pressure Levels (dBA)					
			L_{10}	L_{50}	L_{90}	L_{eq}	Min L	Max L
Secondary Crusher								
A	4/15/94	16:30	67.6	67.1	66.6	66.9	66.2	67.8
B	4/15/94	- - -	65.1	64.6	63.6	64.5	63.1	65.6
C	4/15/94	- - -	68.1	68.1	67.6	67.1	54.3	68.1
D	4/15/94	19:00	72.1	71.6	71.6	71.6	71.3	72.0
Primary Crusher								
E	4/15/94	20:30	70.6	70.1	70.1	70.4	70.0	71.4
E	4/15/94	- - -	74.6	73.6	73.6	73.9	73.3	75.0
E (mean)			72.6	71.9	71.9	72.2	71.7	73.2
F	4/15/94	22:00	70.6	70.6	70.1	70.3	69.6	71.1

[1]A is 100 feet north of the crusher and 50 feet east of the conveyors; B and C are 100 feet east and south of the crusher, respectively; D is 100 feet west of the crusher and 25 feet south of the conveyors. E and F are 100 feet north and south of the crusher, respectively.
[2]Approximate.

TABLE 3-58
Octave Band Noise From Existing Crushers

Monitoring Location[1]	Date	Time[2]	Octave Band Sound Pressure Levels (dB by hertz)										
			31.5	63	125	250	500	1K	2K	4K	8K	16K	A-Wt
Secondary Crusher													
A	4/15/94	16:30	64.5	64.4	65.3	60.2	56.2	53.0	49.2	37.6	33.0	24.6	66.9
B	4/15/94	- - -	62.7	63.1	64.1	60.2	56.4	52.7	48.5	39.3	31.4	25.0	66.9
A (Mean)			62.6	63.8	64.7	60.2	56.3	52.9	48.4	38.5	32.2	24.8	58.6
B[3]	4/15/94	- - -	62.5	60.1	62.1	54.4	51.3	45.0	42.4	28.7	18.6	15.2	53.0
B	4/15/94	- - -	62.0	61.9	63.3	57.2	56.5	50.6	47.3	38.6	35.0	28.1	57.3
B (Mean/High)[4]			62.3	61.9	62.7	57.2	56.5	50.5	47.3	38.6	35.0	28.1	57.2
C	4/15/94	- - -	65.0	64.4	66.0	61.4	57.7	55.0	51.7	39.3	34.1	28.1	66.9
C	4/15/94	- - -	65.5	65.3	67.1	60.6	57.7	54.9	50.7	38.6	32.2	24.6	60.2
C (Mean)			65.3	64.5	66.6	61.0	57.7	55.0	51.2	38.7	33.2	25.5	66.9
D	4/15/94	- - -	71.1	68.7	70.6	67.3	66.1	62.1	60.5	50.0	44.5	38.0	66.9
D	4/15/94	19:00	67.8	69.5	71.4	68.9	68.3	62.4	58.3	48.7	43.3	36.8	68.7
D (Mean)			69.5	68.6	71.0	68.1	67.2	62.3	59.4	49.4	43.9	37.4	66.9
Primary Crusher													
E	4/15/94	20:30	62.7	66.7	71.3	61.8	62.4	58.1	63.3	47.5	41.5	35.1	66.9
C	4/15/94	- - -	65.3	68.4	72.4	61.9	60.4	57.5	54.1	44.4	38.5	33.4	66.9
E (Mean)			64.5	67.6	71.9	61.9	61.4	57.8	58.7	46.0	40.0	34.3	64.6
F	4/15/94	- - -	63.3	65.6	67.9	60.7	60.4	62.2	58.5	43.8	37.9	28.9	65.4
F	4/15/94	22:00	63.9	67.6	68.1	60.8	59.9	58.5	54.5	44.6	37.4	28.9	62.8
F (Mean)			63.6	66.6	68.0	60.8	60.2	60.4	56.5	44.2	37.7	28.9	64.1

[1]A is 100 feet north of the crusher and 50 feet east of the conveyors; B and C are 100 feet east and south, respectively, of the crusher; D is 100 feet west of the crusher and 25 feet south of the conveyors. E and F are 100 feet north and south, respectively, of the crusher.
[2]Approximate.
[3]Cooling fans off for measurements of 250 hertz and above.
[4]Mean for octave bands below 250 hertz higher of the two readings for 250 hertz octave band and above because of cooling fan noise.

TABLE 3-59
Project-Generated Noise Levels
at Sensitive Receptors

Receptor	Noise Level (dBA)	
	Estimated	L_{dn}
Round Mountain School		
Ambient	35.6	42.0
With Project	35.6	42.0
Round Mountain Residence		
Ambient	35.6	42.0
With Project	35.6	42.0
Hadley School		
Ambient	31.7	38.1
With Project	32.0	38.4
SVCO Child Care Center		
Ambient	42.0	48.4
With Project	42.7	49.1

future actions that are near enough to the proposed project to potentially generate interactive noise effects are the possible future dedicated pad sites. Available data are not sufficiently detailed to permit a quantitative noise evaluation of these pads; but, because no expansion of the pit is included in this scenario, it is reasonable to assume that any noise generating activity on the pads would replace similar activity elsewhere on the site. Under this assumption, the pad west of the reusable leach pads and the pad west of the north waste dumps would have essentially no cumulative effect on noise levels at sensitive receptors off the site.

3.14.4 Monitoring and Mitigation Measures

The level and degree of noise effects forecast from the development of the proposed project would not be sufficient to warrant special monitoring or mitigation efforts. Construction of the tailings impoundment would be restricted to daytime hours. All equipment would be maintained in good operating condition with appropriate mufflers tightly and correctly installed.

3.14.5 Residual Adverse Effects

Noise emissions are inevitable from the proposed project. However, the levels anticipated would not be considered significant. Very few observers, if any, would be able to discern the difference between noise levels from the existing operations and those produced by the proposed project.

3.15 Hazardous Materials

3.15.1 Affected Environment

The affected environment for hazardous materials includes air, water, soil, and biological resources that could potentially be affected by an accidental release of hazardous materials during transportation to and from the project site and during storage and use on the project site.

The present mining and ore processing operations at the site require the use of the following materials classified as hazardous: (1) diesel fuel, gasoline, oils, greases, antifreeze, and solvents used to operate and maintain equipment; (2) sodium cyanide, sodium hydroxide, ammonium bisulfite, and nitric acid used in the gold extraction processes; (3) ammonium nitrate and explosives used for blasting in the open pit; and (4) various by-products classified as hazardous waste and chemicals from the assay laboratory.

Pursuant to regulations promulgated under Section 102 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, release of a reportable quantity of a hazardous substance to the environment in a 24-hour period must be reported to the National Response Center (40 Code of Federal Regulations Part 302). The Nevada Administrative Code (445.240) also requires immediate reporting of a release of a reportable quantity of a hazardous substance to the Nevada Division of Emergency Management. ***Table 3-60*** identifies the hazardous materials and reportable quantities that are stored and used at the Round Mountain Mine site.

Minor spills of cyanide solutions or petroleum products have occurred at the project site during previous mining and ore processing operations. Upsets in the leaching process have caused releases of cyanide solutions that were generally confined to the heap-leach facility. Spills of diesel fuel have occurred when equipment is being fueled or as the diesel fuel storage tanks are being filled. Other releases of various types of petroleum products, such as hydraulic fluid, have occurred on the site as a result of mining equipment or machinery failure.

The SVCO has mitigated previous releases of hazardous materials on the project site by following accepted state, federal, and manufacturers' methods. All reported spills have been cleaned up, and contaminated materials have been disposed of

TABLE 3-60
Hazardous Materials List for the Round Mountain Mine Site

Substance	Reportable Quantity[1] (pounds)
Sodium Hypochlorite	100
Acetic Acid Lead Salt (Lead Acetate)[2]	5,000
Ethylene Glycol	1
Calcium Hypochlorite	10
Hydrochloric Acid[2]	5,000
Petroleum Hydrocarbons	100 gallons
Nitric Acid	1,000
Phosphoric Acid	5,000
Silver Nitrate	1
Sodium Cyanide	10
Potassium Cyanide	10
Sodium Hydroxide	1,000
Sulfuric Acid[2]	1,000
Litharge (PbO)	1
Trichloroethane 1,1,1	1,000
Ammonium Bisulfite	5,000

[1] 40 Code of Federal Regulations Part 302.
[2] These compounds are not maintained in quantities sufficient to cause a spill of reportable quantities.

according to federal and state guidelines (RMGC 1/1992 - 7/1994 Water Pollution Control Permit NEV87052). Currently, no contamination is known to exist on the project site as a result of the release of a hazardous material.

Non-hazardous solid waste generated on the site is disposed of in an approved Class III on-site landfill. Used tires are either disposed of in the landfill or recycled with the suppliers. SVCO presently produces three waste streams that are not disposable in the Class III landfill. Stoddard solvent is distilled on the site with the resultant sludges (less than 100 kilograms per month) shipped to a re-refiner. Waste motor oil is produced at a rate of approximately 20,000 gallons per month and is recycled off the site. On-site assay wastes, consisting of slag, crucibles, and cupels, amount to approximately 90 tons production per year. These wastes are shipped to the Cominco lead refinery in Trail, British Columbia, for recycling.

Hazardous waste generated at the Round Mountain Mine site is transported to approved disposal facilities by approved hazardous waste transporters. When practical, hazardous wastes are shipped to a licensed recycling facility.

3.15.2 Environmental Consequences

3.15.2.1 Project-Related Hazardous Materials

The proposed mill and tailings impoundment would require transporting, handling, storing, using, and disposing of additional materials classified as hazardous. Reagents classified as hazardous materials used in the mill would include sodium cyanide, lime, ammonium bisulfite, and copper sulfate. The delivery volumes and intervals and storage volumes of these substances are listed in ***Table 3-61.*** A brief description, including the use and storage of the substances employed during the operation of the mill and tailings facilities, is provided below. All of these substances are neutralized prior to being discharged to the tailings facility.

Sodium Cyanide. Sodium cyanide is the reagent that dissolves the gold/silver component from the concentrate, which is later extracted in the adsorption/desorption and refinery facilities. This reagent would be transported to the mill site as a liquid in specially designed 17,400-pound sodium cyanide haul trucks. It would be stored at the mill in a 16,000-gallon storage tank. The sodium cyanide would be added to the milled unoxidized ore concentrate prior to entering the carbon-in-leach circuit. The remaining cyanide solution from the carbon-in-leach circuit would be routed through a cyanide destruction system that neutralizes any remaining cyanide above the threshold limit before the solution is discharged to the tailings facility.

Lime. Lime would be added to the concentrate in the leach circuit to provide protective alkalinity during subsequent processing.

Ammonium Bisulfite. Ammonium bisulfite is the reagent that would be used to destroy any residual cyanide remaining in the tailings after the carbon-in-leach process. This reagent would be transported to the mill site as a liquid in 48,000-pound capacity tanker trucks and then transferred to a 19,800-gallon storage tank at the mill site. Ammonium bisulfite would be added to the tailings before their disposal in the tailings facility.

Copper Sulfate. Copper sulfate would also be used in the cyanide destruction process. It would be transported to and stored at the mill site as dry powder in 50-pound bags.

In addition to the above-listed materials, there would also be a need for additional amounts of oils and lubricants to operate the mill facility. Overall, the proposed facilities would require an approximately 10 percent increase in the use of these materials at the project site. Currently these materials are stored at the tank farm, which is a storage area located near the maintenance shop. The tank farm facility is designed with containment berms capable of holding 110 percent of the contents of the tanks with ample freeboard. Oils and lubricants would be supplied from the tank farm to the mill by means of mobile equipment, and therefore no additional storage facilities would be necessary. The tank farm has the capacity to hold the 10 percent increase in volume necessary to supply the mill.

The existing heap-leach operation currently uses hazardous materials for ore processing. These hazardous materials include sodium cyanide, sodium hydroxide, and nitric acid. Calcium hypochlorite is used very sparingly for neutralizing any cyanide spills. The sodium cyanide, sodium hydroxide, and calcium hypochlorite are stored at the south adsorption/desorption and refinery facility. These materials are kept in tanks in outside

TABLE 3-61
Hazardous Substances Approximate Daily Usage, Delivery Frequency, and On-Site Storage for the Proposed Mill

Substance	Operational Use	Typical Daily Usage	Nominal Delivery Size	Approx. Delivery Frequency	Storage Area/Volume
Sodium Cyanide	Thickening/ leach/ carbon-in-leach	1,760 lb.	17,400 lb./truck	1 delivery/9 days	Mill site/16,100 gal. tank
Lime	Protective alkalinity	4,586 lb.	40-ton truck and trailer	2 deliveries/ month	Mill site/60 ton tank
Ammonium Bisulfite	Cyanide destruction	8,270 lb.	48,000 lb./truck	1 delivery/5 days	Mill site/19,800 gal. tank
Copper Sulfate	Cyanide destruction	170 lb.	Truck containing 50 lb. bags	1 truckload/ 6 months	Mill site/stored in 50-lb. bags

storage areas that are surrounded with berms capable of holding 110 percent of the contents of the largest tank. The nitric acid is stored separately from the other reagents at the south adsorption/ desorption and refinery site. The nitric acid storage area is also designed with containment berms.

3.15.2.2 Impact Analysis

Important issues related to the presence of hazardous materials at the proposed mill and tailings facility are the potential impacts to the environment from an accidental release of hazardous materials during transport to the proposed mill area or a release related to use or storage at the site. The criterion for evaluating the hazardous materials impacts is the risk of a potential spill and associated impacts to sensitive receptors along transport routes or exposure pathways.

If some of the previously listed chemicals were to enter the environment in an uncontrolled manner, there could be associated direct or indirect adverse effects. The environmental effects of a release would depend on the substance, quantity, timing, and location of the release. The event could potentially range from a minor oil spill on the project site where cleanup equipment would be readily available, to a severe spill during transport involving a large release of cyanide solution. Some of the chemicals could have immediate destructive effects on aquatic resources and water quality if spills were to enter streams such as the Reese River. Spills of hazardous materials could seep into the ground and contaminate the ground water system. Depending on the proximity of such spills to populated areas or the use of degraded water for human consumption, such accidental spills could affect human health.

Transportation. Trucks would be used to transport a variety of non-hazardous materials as well as hazardous materials and wastes to and from the project site. Based on the quantity and number of deliveries, the materials of greatest concern would be cyanide solutions and ammonium bisulfite

The most potentially hazardous delivery to the proposed mill site would be sodium cyanide solutions, with a 17,400-pound tanker truck arriving approximately every 9 days (RMGC 1995). Sodium cyanide solutions would be supplied from Winnemucca, Nevada, located approximately 250 miles from the project site. The most likely transportation route for the sodium cyanide solutions would be east on Interstate 80 to Battle Mountain and south on State Highway 305 to U.S. Highway 50, then south on U.S. Highway 50 to State Highway 376, and south on State Highway 376 to the project access road, State Highway 378. The route crosses the communities of Winnemucca, Golconda, Valmy, Battle Mountain, Austin, and Carvers. The Reese River is also crossed along this route.

Other hazardous materials could be transported from a variety of suppliers located throughout the area. For analysis purposes, a radius of 250 miles was used to determine the risk of a spill occurring while transporting a hazardous material to the

mine site. The 250-mile radius would include additional supply areas such as Las Vegas, Reno, and Ely, Nevada.

The SVCO expects an approximate delivery frequency of one sodium cyanide truck every 9 days and one ammonium bisulfite truck every 5 days to operate the mill facility over the life of the project (12 years). This schedule would result in a total of 486 shipments of sodium cyanide (40 shipments per year x 12 years) and 876 shipments of ammonium bisulfite (73 shipment per year x 12 years) over the life of the project.

The risk of an accident involving deliveries of these two substances was determined using the Department of Transportation truck accident statistics (Abkowitz et al. 1984). According to these national statistics, the average rate of truck accidents for all roads traveled is 0.28 accident per million miles traveled. The probability of an accident and potential release of sodium cyanide and ammonium bisulfite transported to the facility over the life of the project is as follows:

Sodium Cyanide (mill facility):
486 truck deliveries x 250 miles (haul distance) x 0.00000028 accidents per mile = 0.034 releases

Ammonium bisulfite (mill facility):
876 truck deliveries x 250 miles haul distance x 0.00000028 accidents per mile = 0.06 releases

The above analysis indicates that the probability of a release during the transport of either of these substances would be low. Considering that the likely transportation routes would include primarily rural, two-lane roads, and that the probability is based on all types of roads, the actual probability of accidents may be slightly greater.

All hazardous substances would be transported by commercial carriers or vendors in accordance with the requirements of Title 49 Code of Federal Regulations. Carriers would be licensed and inspected as required by the Nevada Department of Transportation. Tanker trucks would be inspected and would have a Certificate of Compliance issued by the Nevada Motor Vehicle Division. These permits, licenses, and certificates are the responsibility of the carrier. Title 49 Code of Federal Regulations requires that all shipments of hazardous substances be properly identified and placarded. Shipping papers must be accessible and must include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

In the event of a release off the project site, the transportation company would be responsible for response and cleanup. Each transportation company is required to develop a Spill Prevention, Control, and Countermeasures Plan to address the materials it would be transporting. Local and regional law enforcement and fire protection agencies also may be involved initially to secure the site and protect public safety.

The SVCO has developed an Emergency Release Response and Contingency Plan for transportation accidents occurring on the project site (RMGC 1994a). This plan includes procedures for notifying the local emergency response personnel and provides for advice, personnel, and equipment as appropriate to minimize the impact of the accident. In addition, the Chemical Manufacturers' Association maintains the Chemical Transportation Emergency Center, which has a 24-hour hotline to provide information, advice, and assistance in identifying and mitigating chemical emergency scenes.

Title 49 Code of Federal Regulations requires that the carrier notify local emergency response personnel, the National Response Center (for discharge of reportable quantities of hazardous substances to navigable waters), and the U.S. Department of Transportation in the event of an accident involving hazardous substances.

Storage and Use. The operation of the proposed mill would require the use and storage of materials classified as hazardous. These materials would be used in the carbon-in-leach circuit and in the cyanide destruction process.

Over the life of the project, the probability of minor spills of materials such as copper sulfate (broken bags) or oils and lubricants is relatively high. These releases could occur as the bags of copper sulfate are handled or possibly as a result of a bad connection on a supply line. Spills of this nature would most likely be localized, contained, and removed. The SVCO would have the necessary spill containment and cleanup equipment available

at the site, and personnel would be able to quickly respond.

The design of the mill and tailings facility would minimize the potential for an upset that could result in a major spill. The mill site would be designed to prevent discharge to the vadose zone (the unsaturated layer above the water table) or to waters of the U.S. Hazardous material storage tanks would have secondary containment sufficient to hold the volume of the largest tank, as well as additional freeboard. Tanks and vessels would be positioned on a concrete containment surface with interior sumps to route any spilled process solutions to lined collection areas. Use and storage volumes of hazardous materials located at the mill site are outlined in ***Table 3-61***.

All hazardous substances would be handled in accordance with applicable Mine Safety and Health Administration or Occupational Safety and Health Administration regulations (Titles 30 and 29 Code of Federal Regulations). The hazardous substances to be used at the mill would be handled as recommended on the manufacturer's Material Safety Data Sheets. With the above-listed design features and operational practices in place, the probability of a major release occurring at the mill would be low.

In the event of a major or minor spill, the SVCO has prepared an Emergency Release Response and Contingency Plan (RMGC 1994a) that establishes procedures for preventing, controlling, and reporting environmental releases within or from facilities located at the Round Mountain Mine. All spills would be cleaned up or neutralized and reported, if required, to the Nevada Division of Emergency Management, the Nevada Division of Environmental Protection, the Bureau of Mining Regulation and Reclamation, the EPA, the National Response Center, the BLM, and the Northern Nye County Emergency Response Coordinator.

3.15.3 Cumulative Impacts

Cumulative impacts resulting from the shipment of hazardous materials (i.e., sodium cyanide) to other mining operations would not occur because the Round Mountain Mine is the only active mine in the region. However, the SVCO does use additional hazardous materials in the existing heap-leach process. As with the proposed mill facility, sodium cyanide is the most potentially hazardous material consumed in the heap-leach operation. Approximately 182 shipments of sodium cyanide are delivered to the mine site each year to operate the heap-leach facility. This would result in an additional 2,184 shipments of sodium cyanide during the 12-year operation of the mill. If the same calculation used to determine the risk of an accident and spill of a hazardous material is applied to the heap-leach operation, there would be a possibility of 0.15 release.

Sodium Cyanide (heap leach):

2,184 truck deliveries x 250 miles (haul distance) x 0.00000028 accidents per mile = 0.15 release

With the addition of the proposed mill and tailings facilities, the amount of sodium cyanide shipped to the mine site would increase by approximately 22 percent. Even with this increase, the chance of an accident resulting in the release of sodium cyanide would remain low.

Possibility of an accident with a release of sodium cyanide (12-year period):

Mill Facility = 0.03 release
Heap Leach = 0.15 release

Total = 0.18 release

The mine would also be receiving shipments of other hazardous materials, such as fuel oil, gasoline, and other process reagents; therefore, the possibility of an accident causing a release of any of the hazardous materials shipped to the mine would be increased. As shown in Section 3.15.2.2, Impact Analysis, this increase would not be significant.

The cumulative effects of using and storing hazardous materials on the project site would be minimized by implementing spill prevention and containment design features along with the Emergency Release Response and Contingency Plan.

3.15.4 Monitoring and Mitigation Measures

HM-1: Even though the potential for accidents involving trucks delivering hazardous materials is low, limiting deliveries to the site to low traffic volume periods would further minimize the potential for accidents.

3.15.5 Residual Adverse Effects

Residual adverse effects from the increased use of hazardous materials on the project site for the proposed action and the tailings impoundment alternative would depend on the substance, quantity, timing, location, and response involved in an accidental spill or release. Prompt cleanup of spills and releases according to the SVCO's Emergency Release Response and Contingency Plan would minimize the adverse effects of such events.

3.16 Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term use of resources during the construction, operation, closure, and reclamation of the project would result in beneficial impacts in the form of additional local employment and the generation of revenue. It would also result in various short-term adverse impacts, such as temporary loss of soil and vegetative productivity, possible wildlife dislocation or mortality, reduced livestock grazing area, increased fugitive dust generation, socioeconomic impacts to the local infrastructure, and increased noise levels. These impacts are expected to end upon closure of operations and would be mitigated through reclamation of the disturbed areas.

Impacts to the long-term productivity of the site (i.e., following project closure and reclamation) would depend primarily on the effectiveness of planned reclamation of the disturbed areas, including the mill site, tailings impoundment, and connecting access and utility corridors. The site currently provides limited forage for grazing livestock and habitat for a few wildlife species. The reclamation goal is to return the disturbed areas to livestock and wildlife grazing by establishing self-sustaining vegetation communities. The revegetation is also expected to stabilize the disturbed surfaces and control erosion of soil from these areas. Under typical moisture conditions at the site, it is expected that initial reclamation efforts would result in sparse stands of perennial grasses, primarily wheatgrasses, with scattered shrubs, such as fourwing saltbush, and abundant invasion of annual weeds, such as halogeton and Russian thistle. With proper management, this initial reclamation community should evolve toward greater abundance of grasses and shrubs with fewer annual weeds. If initial reclamation of the areas occurs in years with above-average precipitation, grasses and shrubs may become established more quickly, thus hastening the trend toward a self-sustaining mixture of predominantly perennial species.

There would be long-term impacts associated with the pit water quality. Pit outflow or human exposure is not anticipated; therefore, potential impacts would be associated with waterfowl and other terrestrial wildlife use of the pit.

3.17 Irreversible and Irretrievable Commitment of Resources

The proposed action or the project alternatives could result in the irreversible commitment of resources (e.g., the loss of future options for resource development or management, especially of nonrenewable resources, such as minerals and cultural resources) or the irretrievable commitment of resources (e.g., the lost production of renewable natural resources during the life of the operation). Irreversible and irretrievable impacts are described below for each resource.

3.17.1 Geology and Minerals

Development of the mill and tailings facility would result in the extraction of an estimated additional 860,000 ounces of gold and an unknown amount of silver from the mineral resource. There are no known economically recoverable mineral deposits located beneath the proposed mill or tailings facility or suspected economically recoverable mineral deposits beneath the alternative tailings impoundment site. Thus, no other irreversible or irretrievable impacts to the mineral resource are anticipated.

3.17.2 Water Resources

From late 1994 through the scheduled end of mining, an estimated 11,560 acre-feet of ground water would be removed as a result of mine dewatering. Of this total, some of the water would be used at the mine site, and the remainder would be discharged to the rapid infiltration basin. A portion of the water discharged to the rapid infiltration basin would infiltrate back into the ground water system, and the remainder would be lost through evapotranspiration. Water used at the site and lost through evapotranspiration would constitute an irretrievable commitment of ground water resources.

In the postmining period, ground water inflow is predicted to result in the development of a pit lake. After the water level in the lake stabilizes, the pit lake is predicted to lose water through evaporation at an estimated rate of 638 acre-feet per year. This evaporative loss is relatively small (approximately 2 percent) compared to the total ground water outflow in the hydrologic study area (Hydro-Search, Inc. 1995). The loss of water flowing into the lake and evaporating from the lake surface represents an irretrievable commitment of water resources.

The SVCO currently has water rights for wells that provide water for mineral processing and other operational needs and pit dewatering. At the conclusion of mining and mineral processing activities and pit dewatering, the SVCO intends to modify the point of diversion from one or more water supply wells and/or dewatering wells to account for the permanent evaporative loss from the pit lake.

The pit lake is predicted to behave as a closed basin with no surface water or ground water outflow. The only anticipated beneficial use of the lake water is as a water source for wildlife. As a result of evaporative concentration, the salinity of the water is predicted to increase over time for the foreseeable future. Eventually, the salinity of the lake would increase to the point where it would no longer be palatable to wildlife. At this point, the pit lake itself would constitute an irretrievable commitment of water resources from a water quality standpoint.

3.17.3 Soils and Watershed

No irreversible or irretrievable soils and watershed impacts are anticipated.

3.17.4 Vegetation

The proposed action would result in the disturbance of existing shadscale, greasewood, and fourwing saltbush vegetation communities with subsequent reclamation to a somewhat different community following revegetation. This disturbance would constitute an irretrievable commitment during the life of the operation. The alternative tailings impoundment would result in similar impacts.

3.17.5 Wildlife

Project construction would result in the mortality or displacement of an unknown number of small mammals, reptiles, birds, and invertebrates that use habitats within the proposed areas of disturbance; these minor wildlife losses would be

irretrievable. Potential wildlife impacts associated with the pit water quality would also be irretrievable.

3.17.6 Range Resources

The proposed action would result in the irretrievable loss of grazing forage on approximately 250 acres of rangeland during project operations and subsequent reclamation. Following reclamation, grazing would resume on the site. The tailings impoundment alternative would result in similar impacts to range resources on approximately 493 acres. The range management alternative would result in an irreversible and irretrievable commitment of resources similar to the proposed action.

3.17.7 Paleontological Resources

No irreversible or irretrievable impacts to paleontological resources are anticipated.

3.17.8 Cultural Resources

The proposed action would result in the irreversible alteration or destruction of prehistoric and historic archaeological sites during project construction; however, none of the potentially affected sites are eligible for the NRHP.

3.17.9 Air Quality

No irreversible or irretrievable air quality impacts are anticipated.

3.17.10 Access and Land Use

Changes in land use and access would generally be reversible through reclamation efforts. The difference in the project area topography following reclamation may limit the types of land use for which the reclaimed area is suitable, but it should remain suitable for the planned grazing and wildlife habitat uses.

3.17.11 Recreation and Wilderness

No irreversible or irretrievable recreation and wilderness impacts are anticipated.

3.17.12 Social and Economic Values

No irreversible or irretrievable socioeconomic impacts are anticipated.

3.17.13 Visual Resources

The proposed project would result in irreversible changes in local views. These changes would partially be mitigated through reclamation to minimize the long-term color and form contrasts of the tailings impoundment.

3.17.14 Noise

No irreversible or irretrievable noise impacts are anticipated.

3.17.15 Hazardous Materials

No irreversible or irretrievable impacts associated with hazardous materials are anticipated.

4.0 Consultation and Coordination

CHAPTER 4.0 Consultation and Coordination

4.1 Public Participation

The public participation program for the Round Mountain Mill and Tailings Facility EIS includes the following components.

Two public scoping meetings were held for the EIS, one on November 9 and one on November 10, 1993, in Hadley and Reno, respectively. The BLM held a briefing for the Nye County Commissioners on December 7, 1993. The public scoping period for the EIS closed on December 31, 1993.

The scoping comments identified the following issues:

- Potential shortage of teachers, classrooms, and funding for the Round Mountain schools
- Relocation of the elementary school from Round Mountain to the Hadley subdivision
- Positive economic impacts of the existing and proposed operations to the local area
- Contribution to the national need for gold production
- Potential impacts of leach residue piles
- Potential pit water quality impacts

The BLM prepared a brief newsletter summarizing the project and the status of the EIS. The newsletter was distributed to the individuals on the BLM's EIS mailing list in June 1994.

In September 1995, the BLM filed the Draft EIS with the EPA. The EPA published notice of the filing in the *Federal Register* on September 22, 1995, and the Draft EIS was distributed to individuals, organizations, and agencies on the BLM's EIS mailing list for review and comment. The comment period for the Draft EIS was 60 days, beginning on September 22, 1995, and ending on November 22, 1995. During this 60-day public comment period, the BLM conducted two public meetings to discuss and accept comments on the Draft EIS (see Section 4.4.2, Public Meeting Comments and Responses).

The EPA will publish a BLM Notice of Availability of the Final EIS in the *Federal Register*. There will be a 30-day public review period following the publication of the Final EIS. A Record of Decision will be issued following the 30-day public review period.

4.2 List of Agency Contacts

During the preparation of the EIS for the proposed mill and tailings facility, the BLM communicated with and received input from various federal, state, and local agencies and private organizations. The following sections list these contacts.

4.2.1 Federal Agencies

U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Bureau of Mines
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service

4.2.2 State Agencies/Universities

Nevada Department of Conservation and Natural Resources
- Nevada Bureau of Mining Regulation and Reclamation
- Nevada Division of Environmental Protection
- Nevada Division of Historic Preservation and Archaeology
- Nevada Division of Wildlife

Nevada Department of Economic Security
Nevada Department of Taxation
Nevada Department of Transportation
Nevada Natural Heritage Program

4.2.3 Local Agencies

Duckwater Shoshone Tribe of the Duckwater Reservation
Nye County Board of Commissioners
Nye County Planning Department
Nye County Public Works Department
Nye County School District
Nye County Sheriff's Department
Round Mountain Junior-Senior High School Administration
Tonopah Chamber of Commerce

Western Shoshone National Council
Yomba Shoshone Tribe

4.2.4 Private Organizations and Companies

Cyprus Tonopah Mining Company
Kennecott Corporation
Nevada Mining Association

4.3 List of Agencies, Organizations, and Persons to Whom Copies of This Statement are Sent

Amendola, Francis
Kennecott Corporation

Arnston, Joanne and Stace
Round Mountain Gold Corporation

Baird, Joseph H.
Givens, Pursley & Huntley, LLP

Barnett, Carl E.
Sierra Pacific Power Company

Barrick Bullfrog, Inc.

Barto, Doug

Beatty Chamber of Commerce

Beatty Town Board

Bennett, Beth
Round Mountain Gold Corporation

Beowawe Geothermal Power Co.

Berg, Kenneth

Berg, Russell

Bernsten, Teri
Nevada Division of Wildlife, Habitat Division

Boyce, Jim
White Mountain Ranch

Boyd, Roy
The Industrial Company

Brandt, Joy K.

Brower, Steve
Round Mountain Gold Corporation

Brown, Tim
Arlemont Ranch

Bryan, Senator Richard H.
United States Senate

Buck, Brian
JBR Environmental Consultants

Campbell, Michael A.

Carson Colony Community Council

Carver, Richard

Casaceli, Teressa
Environmental Management Associates

Central Nevada Newspapers, Inc.

Colman, Charles

Colorado State University Library
Documents Department - KW

Commission for Preservation of Wild Horses

Cox, Alan
Homestake Mining Co.

Cyprus Foote Minerals

Daniels, Eric
Echo Bay McCoy/Cove Mine

Davis, John
Echo Bay Mines

Davison, Pat
National Coalition for Public Lands and
Natural Resources

Deason, Jonathan P., Director
USDI, Office of Environmental Affairs

Death Valley Gateway Gazette

Deisley, David L.
Parsons, Behle & Latimer

Dempsey, Stanley
Environmental Strategies, Inc.

Deweese, Cindy
Lone Tree Mine

Dickinson Library
University of Nevada at Las Vegas

Diercks, Chet and Marlene
Round Mountain Gold Corporation

Dimartini, Paul
D&D Tire

Dombeck, Michael, Director
USDI, Bureau of Land Management

Ducks Unlimited
Western Regional Office

Dupree, Gale
Nevada Wildlife Federation

Dusenbury, Paul

Ely Colony Council Chairman

Ensign, Congressman John
U.S. House of Representatives

Esmeralda County Commission
Planning Coordinator

Etra, Julie
Western Botanical Service

Ewigleben, Don
Echo Bay Mines Ltd.

Frank, Maurice
Cultural Resource Specialist
Yomba Shoshone Tribe

Friesema, Paul

Frost, Gary and Suzanne
Round Mountain Gold Corporation

Garver, Patrick
Parsons Behle & Latimer

Geselbracht, Jeanne
Environmental Review Coordinator
U.S. Environmental Protection Agency

Getchell Library
University of Nevada at Reno

Goerke, Brian
Round Mountain Gold Corporation

Gorda, Mason

Haddock, Richie D.
Santa Fe Pacific Gold Corporation

Harris, Randy and Marjorie
Round Mountain Gold Corporation

Herzog, David
Hydro-Search, Inc.

Hillenbrand, John
U.S. Environmental Protection Agency

Imus, Scott
SAIC

James, Jay
Terramatrix

Jewell, Paula R.
U.S. Humane Society

Johnson, Walter

Jones, Tilman

Jung, Don

Kempton, Houston
PTI Environmental Services

Kirwan, Edward
Phelps-Dodge Corporation

Knight, Maryann
Round Mountain Gold Corporation

Kolbe, Kurt
Bureau of Mining Regulation
and Reclamation

Kraatz, Peter
Environmental Management Association, Inc.

Lappin, Dawn
WHOA!

Las Vegas Colony Council

Levy, Lloyd
Planning Information Corporation

Lista, Felix
Case Pomeroy & Co.

Lovelock Tribal Council

Ludwig, Andrew
ENSR Consulting and Engineering

Lyle, Bill
Battle Mountain Gold Company

Mabe, D. L.

Manzini, Tammy
Lander County Commissioners

Marshall, Shirley
FIB

McQuivey, Robert
Nevada Division of Wildlife, Habitat Division

Mellott, Ron
PTI Environmental Services

Miesner, John
U.S. Fish and Wildlife Service

Miller, Glenn
Sierra Club

Mineral Policy Center

Mohsen, Ahmed
USDI, Bureau of Land Management
Ridgecrest Resource Area

Mousset-Jones, Pierre
Mackay School of Mines
University of Nevada

Mozingo, Jack
SAIC

Myers, Tom

Naccarati, David
Echo Bay Mines, Ltd.

National Wildlife Federation
Public Lands Division

Natural Resources Defense Council

Nature Conservancy
Nevada Public Lands Program

Nettleton, Jerry
ACZ Inc.

Nevada Cattlemen's Association

Nevada Department of Minerals

Nevada Division of Environmental Protection
Bureau of Mining Regulation and Reclamation

Nevada Division of Wildlife

Nevada Miner's and Prospector's Association of Southern Nevada

Nevada Mining Association

Nevada Outdoor Recreation Association

Nevada State Clearinghouse
Department of Administration

Nye County Commissioners

Nye County Library

Oakes, Kathy
WESTEC

Padilla, Butch
Nevada Division of Wildlife, Region III

Parker, Ron
Homestake Canada, Inc.

Parolini, Alan
FB & D Technologies, Inc.

Pastorok, Robert
PTI Environmental Services

Plumbers/Pipefitters Local #350

Protani, Mike
Homestake Mining Company

Protsman, John

Reid, Senator Harry
United States Senate

Reno Sparks Indian Council

Resource Concepts, Inc.

Reuter, Al
Cortez Gold Mine

Rose, Charlie

Rosen, Elyssa

Roukey, Kevin J.
Sacramento District
U.S. Army Corps of Engineers

Round Mountain Gold Corporation

Round Mountain Junior-Senior High School

Russman, Bob

Salisbury, Ray

Sampson, Jennifer
PTI Environmental Services

Sanchez, Virginia
Citizen Alert
Native American Program

Scheidig, Paul
Nevada Mining Association

Sheppard, Ben W. and Monica
Round Mountain Gold Corporation

Sherman, Linda
Royal Gold

Shoshone Paiute Business Council

Sierra Club, Toiyabe Chapter

South Fork Band

Stirland, Meade
Echo Bay Mines Ltd.

Stock, Mark
Hydro-Search, Inc.

Summit Lake Paiute Tribal Council

Terras, Mr. and Mrs.
Round Mountain Gold Corporation

Thomas, Robert D.

Tonopah Chamber of Commerce

Travers, Connie
PTI Environmental Services

Tribal Council of the Te-Moak
Western Shoshone Indians of Nevada

Turk, Fred and Valerie
Round Mountain Gold Corporation

Ulrich, Dan

U.S. Air Force (HQ-USAF/LEEV)
Environmental Division

U.S. Air Force
Office of the Deputy A/S

U.S. Army Corps of Engineers
South Pacific Division, Chief, Planning Division

U.S. Department of Energy, Las Vegas

U.S. Department of Energy
Office of Environmental Compliance (EH-23)

U.S. Department of Energy, Tonopah Test Range

U.S. Environmental Protection Agency
Office of Federal Activities (A-104)

USDA, Humboldt National Forest

USDA, Inyo National Forest

USDA, Soil Conservation Service

USDA, Toiyabe National Forest

USDI, Bureau of Indian Affairs
Area Director's Office and Western
Nevada Agency

USDI, Bureau of Indian Affairs
Eastern Nevada Agency

USDI, Bureau of Indian Affairs
Phoenix Area Office

USDI, Bureau of Land Management
Carson City Office

USDI, Bureau of Land Management
Elko District Office

USDI, Bureau of Land Management
Ely District Office

USDI, Bureau of Land Management
Las Vegas District Office

USDI, Bureau of Land Management
Nevada State Office Print Specialist

USDI, Bureau of Land Management
Winnemucca District Office

USDI, Bureau of Mines
Western Field Operations Center

USDI, Bureau of Reclamation

USDI, Fish and Wildlife Service

USDI, Geological Survey

USDI, Minerals Management Service
Offshore Environmental Assessment Division

USDI, National Park Service
Division of Environmental Compliance

USDI, National Park Service
Division of Environmental Quality

USDI, National Park Service
Superintendent, Death Valley National Park

USDI, Natural Resources Library

USDI, Office of Public Affairs

Valley Electric Association, Inc.

Vucanovich, Congresswoman Barbara F.
U.S. House of Representatives

Walker River Paiute Council

Washoe Tribal Council

Wells Indian Council

Whitaker, Nancy
Animal Protection Institute of America

Whiting, Beverly
Round Mountain Gold Corporation

Wiemeyer, Stan
U.S. Fish and Wildlife Service

Wilderness Society

Williams, Brenda
USDI, Bureau of Land Management

Williams, John
Laser, Inc.

Williams, Ray H., Jr.

Wilmans, Stephen

Wilson, Edie

Winrod, Jay C.

Woods, Marilyn P.
Round Mountain Elementary School

Woods, Warren
Round Mountain Gold Corporation

Wright, William

Yerington Tribal Council

Young, Ann
Round Mountain Gold Corporation

Younkin, Stephen
Sierra Pacific Power Company

4.4 Public Review

4.4.1 Written Comments and Responses

The BLM received 15 letters addressing the Draft EIS during the 60-day public comment period. All letters were reviewed, and comments requiring a response were identified. Responses were provided to clarify the content of the Draft EIS, modify or correct the Draft EIS, or provide additional information in the Final EIS. Comments that did not require one of these responses but may be relevant to the BLM's ultimate decision regarding the Round Mountain Mill and Tailings Facility were given the response "Comment noted." Decisions on how to respond to specific comments were made according to regulations and guidelines in *40 CFR 1503.4* and the BLM's *NEPA Handbook*.

Table 4-1 lists each of the comment letters by author and reference number assigned to the letter. All letters have been reproduced in their entirety in the Appendix to the Final EIS. Furthermore, all letters have been reviewed and considered by the BLM in determining the agency preferred alternative for the proposed project.

The comment letters and responses are presented in the Appendix. Each comment is identified by a bracket and reference number keyed to the letter reference number. Thus, Comment 1-3 refers to the third comment in Letter 1. The response to each comment accompanies the letter and is identified by the reference number of the respective comment (e.g., Response to Comment 1-3).

4.4.2 Public Meeting Comments and Responses

During the 60-day public comment period, several individuals who received copies of the Draft EIS presented verbal comments at the public meetings held in Hadley and Reno, Nevada on October 17 and 18, 1995, respectively. Transcripts of the public meetings and responses to the substantive verbal comments are presented in the Appendix to the Final EIS.

TABLE 4-1
Round Mountain Mill and Tailings Facility
Draft EIS Public Comments

Letter/Transcript Number	Respondent
1	U.S. Environmental Protection Agency
2	U.S. Geological Survey
3	U.S. Fish and Wildlife Service
4	Nevada Division of Environmental Protection
5	Nevada Division of Wildlife
6	Nevada State Historic Preservation Office
7	Nevada Division of Water Resources
8	Nye County
9	Sierra Club - Toiyabe Chapter
10	Round Mountain Gold Corporation
11	Nevada Mining Association
12	Paul Dusenbury
13	Leo C. Vath
14	Ann McCracken
15	Joni Eastley
16	Comment Meeting Transcript - Hadley, NV
17	Comment Meeting Transcript - Reno, NV

5.0 List of Preparers and Reviewers

CHAPTER 5.0
List of Preparers and Reviewers

5.1 Bureau of Land Management EIS Team

Discipline	Name	BLM Office Location
Project Manager, NEPA Review, Noise, Ecological Risk	Christopher Stubbs	Battle Mountain District Office
Air Quality	Gordon Pine	Tonopah Resource Area
Cultural Resources, Paleontology	Pat Hicks	Tonopah Resource Area
EIS Review	Brian Amme	Nevada State Office
Fire Management	Tom Hilken	Battle Mountain District Office
Hazardous Materials	Sue Skinner	Nevada State Office
Lands and Rights-of-Way	Nicholas Williams	Tonopah Resource Area
Minerals	Robert Gunderson	Tonopah Resource Area
Operations	Duane Crimmins	Battle Mountain District Office
Range Management	Mark Swinney	Tonopah Resource Area
Reclamation	Robert Gunderson	Tonopah Resource Area
Recreation, Visual Resources, Wilderness and WSAs	Tracey Pharo	Tonopah Resource Area
Socioeconomics	Paul Myers	Nevada State Office
Soils	Valerie Metscher	Tonopah Resource Area
Threatened and Endangered Plants and Animals, Wildlife, Riparian and Wetlands	Mark Biddlecomb Duane Crimmins	Tonopah Resource Area Battle Mountain District Office
Water Quality and Quantity	Tom Olsen/Mark Biddlecomb	Nevada State Office/Tonopah Resource Area

5.2 Riverside Technology, inc. EIS Team

Discipline	Name	Degree(s) and Experience
Project Manager	Valerie Randall Riverside Technology, inc. Fort Collins, Colorado	BA Urban Studies 17 years experience
Ground Water, Geology, Geochemistry	Patrick Plumley, C.E.G., R.G. Riverside Technology, inc. Fort Collins, Colorado	MS Geology BS Geology 12 years experience
Pit Water Quality	James Drever, Ph.D. University of Wyoming Laramie, Wyoming	Ph.D. Geochemistry; AM Geochemistry MA Chemistry; BA Chemistry 27 years experience
Water Quality	Stephen Johnson Riverside Technology, inc. Fort Collins, Colorado	MS Water Quality Hydrology BS Biology/Chemistry 8 years experience
	William Schenderlein Riverside Technology, inc. Fort Collins, Colorado	MS Civil/Environmental Engineering BS Chemistry/Geological Engineering 2 years experience
Surface Water, Reclamation	James Burrell Riverside Technology, inc. Fort Collins, Colorado	MS Civil Engineering BS Forest Management 14 years experience

Riverside Technology, inc. EIS Team (Continued)		
Discipline	**Name**	**Degree(s) and Experience**
Hazardous Materials	Terry Geiselman, R.G. Riverside Technology, inc. Fort Collins, Colorado	BS Geology 12 years experience
Socioeconomics, Recreation and Wilderness, Access and Land Use	Jennifer Kathol Kathol & Company Fort Collins, Colorado	BS Natural Resource Economics 16 years experience
Wildlife and Fisheries/T&E	Eric Berg Wildland Consultants Loveland, Colorado	MS Range Wildlife BS Wildlife Biology 12 years experience
Air Quality	D. Howard Gebhart Trinity Consultants Inc. Fort Collins, Colorado	MS Meteorology BS Professional Meteorology 15 years experience
Cultural Resources	Thomas Lennon, Ph.D. WCRM Boulder, Colorado	Ph.D. Anthropology 18 years experience
	Edward Stoner, Jr. WCRM Sparks, Nevada	BA Anthropology 11 years experience
Ethnography	Mary Rusco WCRM Sparks, Nevada	MA Anthropology BA Anthropology 39 years experience
Paleontology	K. Don Lindsey WCRM Sparks, Nevada	MA Paleontology BA Paleontology 24 years experience
Range Management, Vegetation/T&E	Russell T. Moore, Ph.D. Poudre Envir. Consultants, Inc. Fort Collins, Colorado	Postdoctoral Ecology Ph.D. Ecology BS Range Management 22 years experience
Soils	James Nyenhuis Poudre Envir. Consultants, Inc. Fort Collins, Colorado	MS Soil Science (in progress) MS Communication BA History 17 years experience
Visual Resources, Noise	Bernhard Strom Planera, Inc. Fort Collins, Colorado	MCRP City and Regional Planning BS Urban Planning 22 years experience
Project Coordinator/ Technical Editor	Susan Blythe Riverside Technology, inc. Fort Collins, Colorado	MA English BA History 5 years experience

6.0 References

CHAPTER 6.0
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7.0 Glossary

CHAPTER 7.0
Glossary

Acid Mine Drainage	Drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.
Acre-feet	The volume of liquid or solid required to cover 1 acre to a depth of 1 foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.
Allotment	A unit of land suitable and available for livestock grazing that is managed as one grazing unit.
Alluvial	Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (e.g., streams and rivers).
Alluvium	Unconsolidated or poorly consolidated gravel, sands, and clays deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.
Ambient	The environment as it exists at the point of measurement and against which changes or impacts are measured.
Animal Unit Months	Grazing of a cow/calf pair for 1 month.
Aquifer	A body of rock that is sufficiently permeable to conduct ground water and to yield economically significant quantities of water to wells and springs.
Artifact	Any object showing human workmanship or modification especially from a prehistoric or historic culture.
Caldera	A large, basin-shaped volcanic depression.
Candidate, Category 1 (C1)	Taxa for which the U.S. Fish and Wildlife Service has substantial information to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher-priority listing work.
Candidate, Category 2 (C2)	Taxa for which the U.S. Fish and Wildlife Service has information to indicate that the listing as threatened or endangered is possibly appropriate. Additional information is being collected.
Clean Water Act	The Federal Water Pollution Control Act, as amended.
Code of Federal Regulations	The compilation of federal regulations adopted by federal agencies through a rule-making process.
Community Types	A group of plants living in a specific region under relatively similar conditions.
Cone of Depression	The depression of heads around a pumping well caused by the withdrawal of water.
Confining Bed	A layer of rock having very low hydraulic conductivity that hampers the movement of water into and out of an aquifer.

Contrast	The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.
Cretaceous	The span of time between 136 and 65 million years ago.
Critical Habitat	Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.
Cumulative Effects	The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future; synonymous with cumulative impacts.
Datum	A point, line, or surface used as a reference in surveying, mapping, or geology.
dBA	The sound pressure levels in decibels measured with a frequency-weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 hertz.
Debitage	Residual lithic material resulting from tool manufacture; represents intentional and unintentional breakage of artifacts either through manufacture of function.
Decibel (dB)	A unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.
Direct Impacts	Impacts that are caused by the action and occur at the same time and place (40 Code of Federal Regulations 1508.7); synonymous with direct effects.
Discharge	The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second, gallons per minute, or million gallons per day.
Disturbed Area	An area where natural vegetation and soils have been removed.
Drainage	Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.
Drawdown	The lowering of the water level in a well as a result of withdrawal; the reduction in head at a point caused by the withdrawal of water from an aquifer.
Endangered Species	Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.
Ephemeral Stream	A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity and whose channel is at all times above the water table.
Erosion	The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Evapotranspiration	The portion of precipitation returned to the air through evaporation and plant transpiration.
Exploration	The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.
Fault	A fracture in rock units along which there has been displacement.
Fault Scarp	Steep rock faces formed by shearing of rock.
Floodplain	That portion of a river valley, adjacent to the channel, that is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.
Forage	Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.
Forb	Any herbaceous plant other than a grass, especially one growing in a field or meadow.
Fugitive Dust	Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.
Game Species	Animals commonly hunted for food or sport.
Geochemistry	The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and their circulation in nature on the basis of the properties of their atoms and ions.
Geotechnical	A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.
Grade	A slope stated in feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).
Ground Water Table	The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.
Heap Leach	The process of recovering gold from low grade ores by leaching ore that has been mined and placed on a specially prepared pad. A chemical solution is applied through low volume emitters, and the metal-bearing leachate solution percolates and is collected.
Heavy Metals	A group of elements, including copper, lead, mercury, molybdenum, nickel, cobalt, chromium, iron, silver, etc., that may be acquired by organisms in trace amounts that are toxic in higher concentrations.
Host Rock	A rock body or wall rock enclosing mineralization.

Hydraulic Conductivity	The capacity of a rock to transmit water. It is expressed as the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.
Hydraulic Gradient	Change in head per unit of distance measured in the direction of the steepest change.
Igneous	Rock or mineral that solidified from molten or partly molten magma; processes relating to or resulting from the formation of such rocks.
Impact	A modification in the status of the environment brought about by the proposed action or an alternative.
Impoundment	The accumulation of any form of water in a reservoir or other storage area.
Indirect Impacts	Impacts that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 Code of Federal Regulations 1508.8); synonymous with indirect effects.
Infiltration	The movement of water or some other liquid into the soil or rock through pores or other openings.
Infrastructure	The basic framework or underlying foundation of a community or project, including road networks, electric and gas distribution, water and sanitation services, and facilities.
Intermittent Stream	A stream that flows only part of the time or during part of the year.
Irreversible	Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.
Jurisdictional Wetland	A wetland area identified and delineated by specific technical criteria, field indicators, and other information for purposes of public agency jurisdiction. The public agencies that administer jurisdictional wetlands are the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the USDA Soil Conservation Service.
Key Observation Point	An observer position on a travel route used to determine visible area.
Landscape Features	The land and water forms, vegetation, and structures that comprise the characteristic landscape.
Lifts	Changes in slopes on the faces of waste rock or heaps that are the result of constructing the dump or heap in a series of layers.
Lithic Scatter (Archaeology)	A discrete grouping of flakes of stone created as a byproduct in the tool-making process. Often includes flakes used as tools as well as formal stone tools, such as projectile points, knives, or scrapers.
Lithology	The description of the physical character of a rock, including mineral composition, grain size, color, and other physical characteristics.

Makeup Water	Water used as a supplement for milling or processing ore to make up for water lost to evaporation.
Mantle	The zone of the earth below the crust and above the core with a transition zone between.
Maximum Credible Earthquake	The largest conceivable earthquake that could occur in an area.
Mil	Unit of measure equal to 0.001 inch.
Mine Rock	Non-ore rock that is extracted to gain access to ore. It contains no ore metals, or contains ore metals at levels below the economic cutoff value, and must be removed to recover the ore; synonymous with waste rock.
Mineralization	The process by which a valuable mineral or minerals are introduced into a rock.
Mitigate, Mitigation	To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.
Monitor	To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.
National Pollutant Discharge Elimination System	A part of the Clean Water Act that requires point source dischargers to obtain permits. These permits are referred to as NPDES permits and are administered by the U.S. Environmental Protection Agency.
National Register of Historic Places	A list, maintained by the National Park Service, of areas that have been designated as being of historical significance.
Native Species	Plants that originated in the area in which they are found, i.e., they naturally occur in that area.
NEPA	The National Environmental Policy Act (NEPA) of 1969; the national charter for protecting the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 CFR 1500-1508 implement the act.
Ore	A deposit of rock from which a valuable mineral or minerals can be economically extracted.
Paleozoic	Span of time from the end of the Precambrian to the beginning of the Mesozoic, ranging from approximately 570 million to 250 million years ago.
Particulate(s)	Minute, separate particles, such as dust or other air pollutants.
Patent	A document conveying title to land from the U.S. Government to private ownership.
Patented Claims	Private land that has been secured from the U.S. Government by compliance with laws relating to such lands.

Peak Flow	The greatest flow attained during melting of winter snowpack or during a large precipitation event.
Perennial Stream	A stream or reach of a stream that flows throughout the year.
Permeable	The property or capacity of a porous rock, sediment, or soil to transmit a liquid.
pH	The measure of the acidity or basicity of a solution.
Plan of Operations	As required by 43 Code of Federal Regulations 3809: Operators submit plans of operation outlines to the Bureau of Land Management that include the name and address of the operator; location of the proposed area of operation; and information sufficient to describe the type of operation proposed, the type of roads, the means of transportation to be used, the period when the proposal will take place, and measures to be taken to meet the requirements for environmental protection.
Porosity	The voids or openings in a rock. Porosity may be expressed quantitatively as the ratio of the volume of openings in a rock to the total volume of the rock.
Potentiometric Surface	A surface that represents the total head in an aquifer; that is, it represents the height above a datum plane at which the water level stands in tightly cased wells that penetrate the aquifer.
Precambrian	Approximately 90 percent of geologic time more than 2.5 billion years old; precedes Paleozoic.
Project Alternatives	Alternatives to the proposed action developed through the NEPA process.
Raptor	A bird of prey (e.g., eagle, hawk, falcon, and owl).
Recontouring	Restoration of the natural topographic contours using reclamation measures, particularly in reference to roads.
Reserves	Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.
Resources (geologic)	Reserves plus all other mineral deposits that may eventually become available—either known deposits that are not yet recoverable at present, or unknown deposits that may be inferred to exist but have not yet been discovered.
Rhyolitic	Extrusive igneous rock with phenocrysts of quartz and alkali feldspar in a glassy groundmass.
Right-of-Way	Strip of land or corridor over which a power line, access road, or maintenance road would pass.
Riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

Runoff	That part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.
Run-of-Mine Ore	Ore taken from a mine or pit directly to a mill for processing.
Sediment	Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, construction activities, or anthropogenic sources, such as forest or agricultural practices.
Sediment Load	The amount of sediment (sand, silt, and fine particles) carried by a stream or river.
Seismicity	The likelihood of an area being subject to earthquakes; the phenomenon of earth movements.
Sensitive Receptors (Noise)	Activities or land uses that are more susceptible than others to noise interference.
Significant	A term used in NEPA determination of significance; requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts, such as society as a whole and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 Code of Federal Regulations 1508.27).
Species	A group of individuals of common ancestry that closely resemble each other structurally and physiologically, and in nature interbreed producing fertile offspring.
Stratification	The layered structure of sedimentary rocks.
Stratigraphy	Form, arrangement, geographic distribution, chronologic succession, classification, and relationships of rock strata.
Tectonics	Large-scale structural features of the upper part of the earth's crust.
Tertiary	Span of time between 65 and 3 to 2 million years ago.
Threatened Species	Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Total Dissolved Solids	Total amount of dissolved material, organic or inorganic, contained in a sample of water.
Total Suspended Solids	Amount of undissolved particles suspended in liquid.
Transmissivity	The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It equals the hydraulic conductivity multiplied by the aquifer thickness.
Tuff	A compacted deposit of volcanic ash and dust that may contain up to 50 percent sediments, such as sand or clay.
Uplift	A structurally high area in the earth's crust produced by upthrusting rocks.

Visual Resource	The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.
Visual Resource Management Classes	A classification of landscapes according to the kinds of structures and changes that are acceptable to meet established visual goals (Bureau of Land Management designation).
Water Table	The level in the saturated zone at which the pressure is equal to the atmospheric pressure.
Waters of the U.S.	A jurisdictional term from Section 404 of the Clean Water Act referring to water bodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds. The use, degradation, or destruction of these waters could affect interstate or foreign commerce.
Watershed	The geographic region from which water drains into a particular stream, river, or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating them.
Weir	An overflow structure built across an open channel, usually to measure the rate of water flow.
Wetlands	Areas that are inundated by surface or ground water with a frequency sufficient to support (and under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

8.0 Index

CHAPTER 8.0
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Appendix
Public Comments and Responses to Draft EIS

Letter 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

November 28, 1995

Christopher Stubbs
Bureau of Land Management
Battle Mountain District
P.O. Box 1420
Battle Mountain, NV 89820

Dear Mr. Stubbs:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the **Round Mountain Mill and Tailings Facility, Nye County, Nevada.** Our comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementation Regulations at 40 CFR 1500-1508, and Clean Air Act Section 309.

The DEIS evaluates alternatives for construction, operation, and reclamation of a mill and tailings facility at the Round Mountain Mine. Ancillary facilities would include a new primary crusher, a power line, water and tailings pipelines, and a septic system. The proposed facilities would be located on 757 acres of public lands administered by the Bureau of Land Management (BLM). Construction and operations would last approximately 12 years. This DEIS also evaluates potential impacts of pit dewatering, pit water quality, and the leach offload piles, which should have been evaluated in previous environmental documents but were not.

We have rated this DEIS EO-2 -- Environmental Objections-Insufficient Information (see the enclosed "Summary of Rating Definitions and Follow-Up Action"). The rating is based on our objection to the overall project because of its potentially significant cumulative adverse impacts. More specifically, we are extremely concerned that the pit lake, which could exceed water quality standards for wildlife, will attract, and adversely impact, waterfowl. Our rating also reflects the need for additional information in the Final Environmental Impact Statement (FEIS) regarding mitigation measures; impacts to soil, vegetation, wildlife, livestock, and springs and seeps; and monitoring.

We appreciate the opportunity to review this DEIS. Please send a copy of the FEIS to the letterhead address, mailcode E-3,

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Letter 1 Continued

when it is officially filed in our Washington, D.C., office. Meanwhile, if you have any questions concerning our comments, please contact Jeanne Geselbracht at (415) 744-1576.

Sincerely,

Deanna M. Wieman, Director
Office of External Affairs

Atch: Detailed Comments (2 Pages)

cc: Doug Zimmerman, NDEP
Mary Jo Elpers, U.S. FWS
Nevada Division of Wildlife

Letter 1 Continued

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation rneasures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective rneasures rnay require changes to the preferred alternative or application of mitigation rneasures that can reduce the environmental irnpact. EPA would like to work with the lead agency to reduce these irnpacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that rnust be avoided in order to provide adequate protection for the environment. Corrective measures rnay require substantial changes to the preferred alternative or consideration of sorne other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient rnagnitude that they are unsatisfactory frorn the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these irnpacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recornrnend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental irnpact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer rnay suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Irnpacting the Environment."

Letter 1 Continued

Detailed Comments

We commend the BL for evaluating the potential environmental impacts from pit dewatering, pit water quality, and the leach offload pile. It is unclear, however, why these impacts (which are also directly associated with previous project proposals), were not assessed in earlier NEPA documents prepared by BLM. It appears that this serious oversight could have resulted in the approval of the pit excavation without knowledge of the full range of potential adverse impacts.

Based on the results of the ecological risk assessment, the Round Mountain pit lake may cause long-term impacts to individual waterfowl, as well as population-level impacts (DEIS, p. 3-88). However, we understand the Nevada Division of Environmental Protection (NDEP) requires that pit waters shall not adversely affect terrestrial or avian life, or human health. We also understand that the pit excavation permit has been previously approved based on an assumption that impacts would be insignificant. In light of the current impact analysis and ecological risk assessment, it is unclear what options BLM and NDEP have regarding that previous approval. It is also unclear what measures would be required of the Smoke Valley Common Operation in order to prevent exceedences of NDEP's standards. According to the DEIS, the pit lake water quality would be monitored during mine reclamation and closure (about two years), and NDEP would require post-closure monitoring (p. 3-89).

1-1 However, the DEIS does not discuss the mitigation measures that would be required to prevent impacts to waterfowl (as projected in the risk assessment). Pursuant to 40 CFR 1502.16(h), the FEIS should discuss means to mitigate adverse environmental impacts, which include not only direct impacts of the proposed project, but indirect and cumulative impacts as well.

1-2 According to the DEIS (p. 3-53), water quality standards applicable to the lake would depend on the potential beneficial uses of the lake. The FEIS should identify the potential beneficial uses of the lake.

The DEIS, on page 3-89, states that the tailings impoundment would be monitored for dead or dying waterfowl to prevent any violation of the Migratory Bird Treaty Act. It is unclear how

1-3 monitoring would prevent violation of the Act. The FEIS should discuss mitigation measures that would be implemented to prevent birds from dying from exposure to the tailings impoundment. If prevention measures would not be completely successful, we suggest that off-site mitigation measures be considered as well.

Response to Letter 1

01-01 The ecological risk assessment presented in the EIS is not, in itself, intended to be a decision-making study to evaluate the mitigation of potential environmental impacts based on modeled scenarios. The risk assessment is a tool to help the responsible agencies and the public understand the potential impacts that could occur to wildlife from elevated constituents in the pit lake. The Nevada Division of Environmental Protection requires postclosure monitoring of the pit lake for 30 years after closure. Should elevated constituents be indicated through monitoring, the Nevada Division of Environmental Protection, through its Water Pollution Control Permit, would require the operator to implement mitigation measures to offset impacts identified during that time and to prevent violation of the Nevada Administrative Code regarding pit lakes and degradation of waters of the State. Postclosure monitoring will determine actual water quality trends. Mitigation, if required, would be developed as necessary under the Clean Water Act by the State and the BLM based upon actual conditions and best management practices, rather than the predicted long-term impacts to wildlife.

In an attempt to offset wildlife impacts that may occur, Round Mountain Gold Corporation has implemented off-site wildlife mitigation that is outlined in the response to comment 01-03.

01-02 The potential beneficial uses of the pit lake water are identified in Sections 3.2.2.1 and 3.17.2 of the Draft and Final EIS. For additional clarification, a sentence has been added to Section 3.2.2.1 **(page 3-59)** of the Final EIS to indicate the only anticipated potential beneficial use of the lake water is as a water source for waterfowl and small mammals.

01-03 Please refer to the paragraph on page 3-89 of the Draft EIS that describes the proposed process for neutralizing the tailings impoundment, including testing the tailings material to ensure the effectiveness of the neutralization process.

Round Mountain Gold Corporation has implemented off-site wildlife habitat enhancement programs. At the Manhattan Mine, Round Mountain Gold Corporation initiated a "Wildlife at Work Program" with the Wildlife Habitat Council; the purpose of the program is to develop wildlife enhancement projects during site reclamation at the mine. In addition, Round Mountain Gold Corporation, the BLM, and Ducks Unlimited cooperated in an effort to enhance existing wetlands and riparian areas in the Railroad Valley Wildlife Management Area in central Nevada.

Letter 1 Continued

1-4 According to the DEIS (p. 2-14), process ponds and ditches are "covered." We understand they are netted to prevent birds from landing in them. However, the DEIS states that there have been waterfowl deaths associated with the existing operations, primarily caused by entrapment in nets covering the ponds and a smaller number from contact with process solutions and other causes (p. 3-77). The FEIS should discuss the mitigation measures would be taken to improve existing efforts to exclude wildlife.

1-5 The DEIS states that the potential exists for stormwater runoff to mobilize metals and cyanide from the spent ore material. All stormwater runoff is expected to infiltrate at the margin of the offload piles or flow to stormwater sedimentation/infiltration structures (p. 3-45). The FEIS should discuss the potential effects of contaminant concentrations in the soil from runoff and how these areas would be reclaimed so as to prevent any adverse impacts to vegetation, wildlife, and livestock. The discussion should take into account impacts of the two additional dedicated leach pads that may be constructed within the next five years.

1-6 The DEIS includes projected groundwater drawdown contours that would result from pit dewatering. The smallest groundwater drawdown contour is 10 feet. Figure 3-14 should depict the zero drawdown contour, and the FEIS should discuss whether a drawdown of less than 10 feet would potentially affect springs or seeps in the area.

1-7 It is unclear why process water is pumped from three wells located 4.5 miles from the mine, while 200 to 600 gallons per minute of water extracted from pit dewatering wells is recharged into a rapid infiltration basin. This should be clarified in the FEIS.

1-8 The FEIS should discuss what procedures would be followed if a leak were detected in the primary or secondary liners of the tailings collection ponds or sediment pond adjacent to the tailings impoundment.

1-9 Calculations based on a 100-year, 24-hour storm were used to design stormwater diversion around the tailings facility. The FEIS should discuss whether a shorter time interval such as six hours would be more appropriate.

1-10 The DEIS states that groundwater monitoring would be conducted in concurrence with the Nevada Division of Environmental Protection's Bureau of Mining Regulation and Reclamation. The FEIS should specifically identify the monitoring that would be required and describe that which would be undertaken.

Response to Letter 1

01-04 Existing processing pond surfaces have been covered with 4-inch high density polyethylene balls to eliminate the reflective surface and to preclude waterfowl access to the process solution. Perimeter nets hold the balls in place from wind action.

01-05 The potential impacts associated with soil contamination due to runoff from the leach offload piles have been added to Section 3.2.2.1 **(pages 3-45 and 3-47)** of the Final EIS. In addition, mitigation measure WR-3 has been added to Section 3.2.4 **(page 3-63)** of the Final EIS as a measure to minimize potential exposure to wildlife and livestock during operation and postclosure. With respect to cumulative impacts from the two additional dedicated leach pads that may be constructed within the next 5 years, information on the design of these facilities is not available at this time. However, dedicated heaps are typically designed as zero discharge facilities. It is anticipated that if these facilities are properly designed and constructed (as required by the Nevada Division of Environmental Protection), the potential for soil contamination from these activities should be minimal.

01-06 As stated on page 3-37 of the Draft EIS, a ground water decline of 10-feet or more was selected to establish the general area of drawdown impacts. This threshold was established by the BLM based on the fact that natural fluctuations in water levels, particularly in fractured rock aquifers, commonly exceed 10 feet. Drawdowns of less than 10 feet are not considered since these changes would probably not be measurable or distinguishable from natural seasonal or annual fluctuations. These fluctuations result from a combination of seasonal and annual variations in ground water recharge and the relatively low storage properties of the fractured bedrock aquifers. Studies from other similar mountain ranges have shown that fluctuations on the order of 10 to 50 feet are not uncommon. Therefore, in this hydrogeologic setting, the effects of even a 10-foot change in the water table may not be measurable or distinguishable from natural fluctuations.

01-07 The SVCO is designing the mill process system to use all water from the pit dewatering wells. Approximately 200 gallons per minute of dewatering water are currently used for dust control on roads.

01-08 The tailings collection ponds and the sediment pond are designed so that solution can be diverted to any one of the three ponds. If a leak were detected in one of the three ponds, the solution would be diverted from the pond with the leak to one of the other ponds. The leaking pond would be drained and the leak repaired. A discussion of the procedures that would be followed if a leak were detected in the ponds has been added to Section 3.2.2.1 **(page 3-50)** of the Final EIS.

01-09 Section 3.2.1.1 **(pages 3-21 and 3-22)** of the Final EIS has been revised to add 6-hour events and to indicate that 24-hour events typically generate the largest runoff peaks and volumes.

01-10 The tentative location of the monitoring wells to be completed around the tailings facility has been added to the Final EIS as shown in Figure 3-21 **(page 3-62)**. The description of the monitoring program has been expanded in Section 3.2.4 **(page 3-61)** of the Final EIS.

Letter 2

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Reston, Virginia 22092

In Reply Refer To:
Mail Stop 423

NOV 2 8 1995

MEMORANDUM

To: Regional Director, Bureau of Land Management

From: James F. Devine
Senior Advisor for Science Applications

Subject: Review of Draft Environmental Impact Statement for the Round Mountain Mill and Tailings Facility

The subject document has been reviewed, as requested by the Office of Environmental Policy and Compliance, to evaluate the technical adequacy of analyses related to water resources that potentially may be affected by the proposed actions. The following comments concern: (1) section 2.3.2, 'Proposed Action—Tailings Facility' and (2) section 3.2.2, 'Water Resources—Environmental Consequences'.

2-1 • Pages 2-19 and 2-20: The document estimates 85 percent recovery of process water for re-use in the tailings facility. The fate of the lost process water is not addressed.

2-2 • Pages 3-53 through 3-58: It appears that simplistic assumptions were utilized to model the geochemistry of the complex pit-lake ground-water system. Assuming cessation of sulfide oxidation in a completely oxygenated aquatic system that receives possibly reduced ground-water inflow is not realistic. It also is not realistic to assume that a 300 foot deep pit lake will remain entirely oxygenated through the period simulated. However, because of the steep sidewalls of the pit and the planned berm surrounding its perimeter, the environmental consequences of pit-lake geochemistry and related hazards to humans and to fish and wildlife probably will remain small.

Copy to: Director, Office of Environmental Policy and Compliance
District Chief, Water Resources Division, Nevada

Response to Letter 2

02-01 A description of the process water loss from evaporation has been included in Section 2.3.2 **(page 2-20)** of the Final EIS.

02-02 Cessation of Sulfide Oxidation in a Completely Oxygenated Aquatic System: The diffusion rate of oxygen is four orders of magnitude slower in water than in air (Himmelblau[1]). Thus, because the rate of oxygen transfer to the surface of the sulfide minerals is so much slower in an aqueous environment, submersion effectively halts sulfide oxidation. In fact, subaqueous disposal of mine waste is being used at many mine sites to control the risk of acid mine drainage (AMD). "The placement of reactive waste under water cover has proven to be a highly effective method for AMD control. Water cover is an effective barrier to the gaseous diffusion of oxygen. The prime mechanism for oxygen entry into saturated reactive waste is by convective transport of dissolved oxygen in ground water or infiltrating water. At the typical flows of water entering the submerged waste, oxidation rates are normally very low and of minor consequence" (SENES[2]). Thus, available evidence indicates that sulfide oxidation will effectively cease when the wall rock is inundated with ground water.

In addition, hydrologic modeling at the Round Mountain mine has shown that diffusion of solutes out of the pit lake will be very slow relative to the influx of ground water from the surrounding aquifer (Hydro-Search, Inc.[3]). Therefore, the transport of solutes, including dissolved oxygen, out of the pit lake into the surrounding wall rock can be expected to be negligible. The inflowing ground water will have traveled through sulfide-bearing rock, and thus cannot be expected to contain significant levels of dissolved oxygen. Therefore, the presence of oxygen in the pit lake water column will not result in significant pyrite oxidation in the surrounding wall rock.

Pit Lake Oxygenation Throughout Entire Depth: Oxygenation of the Round Mountain pit lake will depend on biological and chemical oxygen demand in the lake and on the degree of mixing that occurs within the lake. Although this comment appears to suggest that the pit lake would be too deep to remain oxygenated, observations from other lakes indicate that deep lakes (e.g., greater than 100 feet deep) that exhibit yearly turnover are often oxygenated throughout the entire profile, while shallower lakes may be anoxic at depth. PTI[4] describes thermal modeling of the Round Mountain pit lake that was performed to evaluate the degree of mixing in the lake. As is common with many Nevada lakes, the Round Mountain pit lake is predicted to stratify during the summer months, but to turn over in the fall (i.e., it would be a monomictic lake). This turnover would result in annual mixing of the lake and replenishment of dissolved oxygen in the hypolimnion.

The chemical and biological oxygen demand in the Round Mountain pit lake was also evaluated, as described in Section 5.3 of PTI's pit-lake water quality modeling report (PTI[4]). These analyses indicated that the lake would remain oxygenated throughout its entire depth at all times.

Response to Letter 2

[1] Himmelblau, D.M. (1964). Diffusion of dissolved gases in liquids. *Chem. Rev.* 64:527-550.

[2] SENES Consultants, ltd. (1995). Review of In-Pit Disposal Practices for the Prevention of Acid Drainage - Case Studies. Report prepared for the Mine Environmental Neutral Drainage Program. Ottawa, Ontario.

[3] Hydro-Search, Inc. (1994). Ground-water Model Results, Round Mountain Mine, Environmental Impact Statement, Round Mountain, Nevada. Reno, Nevada.

[4] PTI. (1995). Predicted water quality in the Round Mountain Mine pit lake, Nye County, Nevada. Boulder, Colorado.

Letter 3

United States Department of the Interior

FISH AND WILDLIFE SERVICE
NEVADA STATE OFFICE
4600 KIETZKE LANE, BUILDING C-125
RENO, NEVADA 89502-5093

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November 22, 1995
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Memorandum

To: Environmental Impact Statement Project Manager, Battle Mountain District Office, Bureau of Land Management, Battle Mountain, Nevada (Attn: Christopher Stubbs)

From: State Supervisor, Nevada State Office, Reno, Nevada

Subject: Round Mountain Mill and Tailings Facility Draft Environmental Impact Statement and Risk Assessment

The Fish and Wildlife Service (Service) has reviewed the pit lake Ecological Risk Assessment and Draft Environmental Impact Statement (DEIS) for the proposed Round Mountain Mill and Tailings Facility to be constructed at the Smokey Valley Common Operation gold mine in Nye County, Nevada. In addition, Service staff met with representatives of the Smokey Valley Common Operation, Nevada Division of Wildlife, Bureau of Land Management (Bureau) and various contractors on October 18, 1995, to discuss general comments pertaining to the pit lake risk assessment and DEIS. Following are the Service's general and specific comments to the risk assessment and DEIS.

PIT LAKE ECOLOGICAL RISK ASSESSMENT

General Comments

The Service found the methodologies used in the risk assessment to be in general accordance with current guidance and believes the risk assessment to be fundamentally sound. However, the Service questions some of the assumptions and evaluation techniques used in the risk assessment.

Letter 3 Continued

3-1 Upon reviewing the risk assessment, the Service believed that dose was the only exposure scenario considered, and that effects related to contaminant accumulation were not included. However, in the October 18, 1995, meeting, it was explained that the risk assessment did consider contaminant accumulation, but included these effects along with effects related to contaminant doses. The Service believes that effects related to dose and accumulation are two different manifestations of impacts related to contaminant uptake and should be evaluated separately, especially for trace elements which can potentially bioaccumulate through food webs.

3-2 The Service is concerned that the use of allometric scaling factors presented in Opresko et al. (1994) and Nagy (1987) to extrapolate toxicity factors between laboratory test species and wildlife species does not account for all potential variability between these two groups, and does not address specific sensitivities which may be observed in the receptor species evaluated by this risk assessment. While the Service agrees that much of this information is lacking in the field of ecotoxicology, the Service does not agree that simple mathematical extrapolations are sufficient to describe the physiological differences between species. In the absence of empirical data, the Service recommends the use of formalized uncertainty factors to ensure conservative estimates when using allometric scaling.

3-3 The screening-level risk assessment used Nevada State drinking water standards as a rough estimation of risk to wildlife potentially exposed to trace element concentrations in the pit lake. The screening-level risk assessment should also use Nevada State aquatic life standards for this comparison.

3-4 The risk assessment compared predicted concentrations of numerous trace elements to concentrations reported for a number of Nevada Wildlife Management Areas (WMA), assuming that water quality at WMAs has not been affected by anthropogenic sources and is indicative of background conditions. The Service does not agree that the WMAs selected for this comparison have not been impacted by anthropogenic sources, or are representative of background conditions; in fact, the WMAs selected have been heavily impacted by a variety of anthropogenic sources, including historic mining, irrigation projects, and urban drainage. The Service does not believe this comparison is essential for the successful completion of this project, and recommends removing this comparison from both the risk assessment and DEIS.

3-5 The food web model used hazard quotients (HQ) based on No Observed Adverse Effects Level (NOAEL) values exclusively in the original estimation of risk. The Service agrees with this approach as NOAEL values are comparable in their interpretation (i.e., no observed effects). However, when these HQs exceeded the value of 1, the model was rerun using HQs based on Lowest Observed Adverse Effects Level (LOAEL) values. The Service questions this approach because the use of varying levels of protection (NOAEL vs. LOAEL) limits comparability between species or contaminants. Also, LOAEL values are, by definition, levels of observed adverse effect, and are not considered protective in a preliminary,

Response to Letter 3

The pit water quality analysis, the ecological risk assessment, and the associated sections of the Final EIS have been revised to reflect additional kinetic test data and in response to comments.

03-01 There are two ways in which bioaccumulation can be considered in an ecological risk assessment. The first involves comparing concentrations (or body burdens) of chemicals with effects. For example, the concentration of a metal in bird eggs could be measured and the percentage of those eggs that successfully hatch could be compared with the hatch rate of eggs with a lesser concentration of the metal. Concentrations of chemicals in biota were not used to predict effects on biota because these concentrations would have been estimated using toxicokinetic models, and such estimates would have been based on an estimated dose. Carrying an estimated dose through another modeling exercise to estimate concentrations in biota would have added uncertainty to an already predictive approach. In addition, toxicological data on effects are more often reported in terms of dose to the test organism than in terms of concentrations in biotic tissues; reports of effects associated with chemical body burdens from laboratory studies are less common.

The second way in which chemical accumulation can be considered in an ecological risk assessment is by using estimated (or measured) concentrations in the prey of receptors of concern in a food web model to estimate the daily chemical intake rate by the receptor of concern. In this manner, effects related to chemical bioaccumulation were integrated into both the screening risk assessment and into the food web model of the ecological risk assessment.

03-02 It is difficult, even with formalized uncertainty factors, to account for all of the potential variability in toxicological response between laboratory animals and wild species. Use of uncertainty factors to calculate minimal risk levels for humans is, by definition, a highly conservative approach to interspecies extrapolation and is designed to lead to extremely low risk levels for humans. While standard uncertainty factors have been developed for calculating reference doses for human health risk assessment, standard uncertainty factors for wildlife risk assessment are not available.

Nonetheless, many of the toxicity reference values reported by Opresko et al.[5] and used in the risk assessment already incorporate uncertainty factors. For example, when the duration of exposure in a toxicity study is not long enough to meet the definition of a chronic study, Opresko et al.[5] multiply the reported "subchronic" no-observed-adverse-effect level by an uncertainty factor of 0.10 to obtain a chronic no-observed-adverse-effect level. In addition, when the laboratory species is smaller than the receptor species, the use of allometric scaling factors is often more conservative than established uncertainty factors. For example, scaling from a mouse (body weight equal to 0.03 kilograms) to a mule deer (body weight equal to 66.5 kilograms) using allometry results in the equivalent of an uncertainty factor of 0.076, which is more protective than the typical assumption of an uncertainty factor of 0.10.

Response to Letter 3

The BLM recognizes the current debate regarding the relative usefulness of allometric scaling factors and uncertainty factors. However, while uncertainty factors are somewhat arbitrary and can result in overly conservative risk estimates, the use of allometric models for dosimetry scaling is more species-specific and has a long history of use in scaling doses of therapeutic drugs and toxic chemicals for humans and between species.

Data presented by Nagy[6] do not involve extrapolation of toxicity reference values between laboratory species and wildlife. Nagy[6] presents an analysis of metabolic rates of wild species as a function of body weights and provides statistical models from which food ingestion rates can be estimated. Regression equations provided by Nagy[6] and used in the risk assessment are statistically significant ($P < 0.005$) with high correlation coefficients ($r^2 > 0.89$). These equations are useful and defensible when empirical studies of the feeding and drinking rates of receptors are not available.

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[5] Opresko, D.M., B.E. Sample, and G.W. Suter II. (1994). Toxicological benchmarks for wildlife: 1994 revision. ES/ER/TM-86/R1. Prepared for the U.S. Department of Energy. Oak Ridge National Laboratory. Oak Ridge, Tennessee.

[6] Nagy, K.A. (1987). Field metabolic rate and food requirement scaling in mammals and birds. *Ecol Monogr.* 57:111-128.

03-03

The use of aquatic life criteria for screening chemicals (i.e., for identifying chemicals to be analyzed using the food web model) is misleading. The receptors of concern for the risk assessment are large terrestrial mammals and birds that may use the pit lake. Aquatic life criteria are derived to protect the most sensitive life stage of the most sensitive aquatic species. In a few cases (e.g., for chemicals such as mercury or polychlorinated biphenyls that can bioaccumulate significantly in fish), the criterion is driven by the risk to wildlife (or humans) eating aquatic prey, usually fish. Therefore, using aquatic life criteria for screening could lead to a food web model of chemicals that may pose no risk to ungulate mammals or insectivorous birds. It would also be possible to overlook chemicals that should be modeled. Therefore, in the Final EIS, human health drinking water standards were used to identify chemicals that required additional modeling for mammals, and species-specific benchmark concentrations for mallards were used to identify chemicals for which additional modeling for birds was required.

Nonetheless, a comparison of predicted chemical concentrations to national and Nevada aquatic life criteria is provided in the final risk assessment (PTI[7]). The results of this comparison are relevant only to potential effects on aquatic species, not birds and mammals.

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[7] PTI. (1995a). Assessment of risk to wildlife from predicted chemical concentrations at the Round Mountain Gold Corporation pit lake, Nevada. Bellevue, Washington.

03-04

The use of wildlife management areas as reference areas for comparing pit lake water quality has been deleted from the ecological risk assessment and the Final EIS.

Letter 3 Continued

3-5 conservative risk assessment. The Service recommends using only NOAEL values for evaluating risk as this consistency allows comparison of risks between species and contaminants.

3-6 The Service is concerned with the methods used to evaluate the results of this risk assessment. It is stated that HQs < 1 represent a very low probability of effects upon the specific receptor population from the specific trace element, and that HQs > 10 represent high probability of effects upon the receptor population from the specific trace element, and the Service agrees. However, the Service believes the statement that HQs between 1 and 10 do not represent significant risk of adverse effects to the reproductive potential of populations is incorrect when applied to all cases. Several of the toxicity reference values selected for this risk assessment are based on studies which evaluated a population endpoint, such as survival or productivity. If a HQ based on a population endpoint exceeds the value of 1, the risk assessment has, by definition, predicted a risk to the subject population. Predicted risk should not be discounted by evaluating assumptions or uncertainties used in an assessment at this level of detail. These evaluations should occur in a more-detailed, data-driven risk assessment, if performed.

3-7 The risk assessment does not develop hazard indices (HI) for the various receptors. This risk assessment has been developed to evaluate the total potential impact to natural resources resulting from exposure to poor quality water in the pit lake. As such, HIs for each compound should be developed and presented in the risk assessment. The argument is made that some of the trace elements considered in the risk assessment have a toxicologically antagonistic behavior. While this may be true, current risk assessment guidance calls for the development of HIs using the sum of all HQs for each receptor species. If an appropriate, scientifically valid method can be developed to account for toxicological behaviors other than simple additivity, the Service would be willing to consider that methodology for use in this risk assessment.

3-8 At the October 18, 1995, meeting, the Service presented a reference to a scientific publication on the effects of selenium to birds. That reference was Skorupa and Ohlendorf (1991). Also, the Service noted that water quality predictions and an effects assessment for boron were missing from the risk assessment. The Service is concerned that boron levels in this area may become elevated to the point of posing a risk to wildlife, and should be included in the risk assessment.

3-9 During presentations at the October 18, 1995, meeting, the Service learned that new ground water quality data had become available subsequent to the release of the current version of the risk assessment. It was stated at this meeting that the new data would have a substantial effect on predictions of water quality in the pit lake. As the risk assessment evaluates potential effects resulting from exposure to this water, the Service requests that the risk assessment model be re-run with the new data, and that the risk assessment be released for review and comment prior to the release of the final version of the EIS for the mill and tailings facility.

Response to Letter 3

03-05 A no-observed-adverse-effect level reported in a toxicity study indicates the highest dosage at which no significant effects were observed. The no-observed-adverse-effect level therefore provides no information concerning the actual dose at which effects are expected. The lowest-observed-adverse-effect level indicates the lowest dosage at which a significantly higher incidence of the toxicity endpoint (e.g., reduced growth) occurred in treated individuals. Thus, when a predicted dose does not exceed the no-observed-adverse-effect level there is confidence that no effects are expected. When a predicted dose exceeds the no-observed-adverse-effect level, it is still not known whether the predicted dose is high enough to initiate a toxic response; therefore, it is instructive to compare the predicted dose to a lowest-observed-adverse-effect level. The extent to which the predicted dose exceeds a dose known to be associated with specific adverse effects provides valuable information to the risk assessment and is consistent with the EPA's guidance for risk assessments. This comparison of estimated doses to both no-observed-adverse-effect levels and lowest-observed-adverse-effect levels does not impart varying levels of protection to receptors. The use of lowest-observed-adverse-effect levels to provide a perspective on predicted doses to receptors was used in the Final EIS. The text of the Final EIS (**page 3-88**) and PTI's risk assessment[7] have been revised to better convey the rationale for using lowest-observed-adverse-effect levels.

03-06 None of the toxicity studies used as the basis for toxicity reference values were conducted on populations, and none of the studies reported productivity as a toxicity endpoint. All toxicity studies used for the ecological risk assessment evaluate the effects of chemical exposure on individuals. For example, the mortality and body weight of individual mallard ducks fed zinc were monitored by Gasaway and Buss[8] who reported a lowest-observed-adverse-effect level of 300 milligrams of zinc per kilogram per day. Although the endpoints for the selected toxicity reference values are relevant to population-level effects, they are not direct indicators of population effects. Thus, a hazard quotient greater than 1 in this risk assessment does not necessarily indicate a population-level risk.

To report a population-level toxicity reference value, a study should dose all age classes simultaneously and report the dose at which measured characteristics of the subsequent generations are significantly different than those same characteristics in control populations. Population-level endpoints may include population density or biomass, age distribution, or the ratio of mature females to mature males. Laboratory toxicity studies on populations typically involve microbes or zooplankton, species usually not valued enough by society to appear as the targets of risk assessment.

Response to Letter 3

According to Lawrence Barnthouse, "responses of [populations and ecosystems] cannot be predicted from toxicity tests alone. The response of a fish population, for example, to a contaminant exposure will depend on ... the inherent capacity of the population to compensate or to evolve in response to exposure" (Suter[9]). The statement that hazard quotients between 1 and 10 do not indicate significant risks to *populations* is made in the context of the compensatory mechanisms of population dynamics. For example, if some fraction of juveniles of a population suffers mortality from chemical exposure, those that survive will have greater access to food and habitat resources. This is the same logic that has supported fisheries management models and sustainable harvest concepts.

Risk is an expression of the probability of adverse effects. In this respect, the hazard quotient alone does not quantify risk. In ecological risk assessment, the hazard quotient provides one line of evidence in a complex investigation. Guidance provided by the EPA[10,11] specifically prescribes a weight of evidence evaluation in which corroborative information (e.g., the extent of habitat development), the sufficiency and quality of the data (e.g., empirical or modeled), and available evidence of causality (e.g., the hazard quotient) are considered. The objective, in the absence of a quantitative risk estimate, is a qualitative statement of risk to the ecosystem. Therefore, predicted risk was not discounted in the risk assessment. Several lines of evidence were integrated to provide a summary of relevant information upon which to make judgments, which is consistent with EPA guidance.

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[8] Gasaway, W.C., and I.O. Buss. (1972). Zinc toxicity in the mallard. *J. Wildl. Manage.* 36:1107-1117.

[9] Suter, G.W. (1993). *Ecological Risk Assessment.* Lewis Publishers. Boca Raton, Florida.

[10] EPA. (1992). Framework for ecological risk assessment. EPA/630/R-92/001. U.S. Environmental Protection Agency, Risk Assessment Forum. Oak Ridge, Tennessee.

[11] EPA. (1994). Ecological risk assessment guidance for Superfund: process for designing and conducting ecological risk assessments. Review Draft. U.S. Environmental Protection Agency, Environmental Response Team. Edison, New Jersey.

Response to Letter 3

03-07

Current ecological risk assessment guidance (EPA[11]) states that "if multiple contaminants of ecological concern exist at the site, it may be appropriate to sum the [hazard quotients] for contaminants *with the same ecological effect endpoint and/or the same mechanism of toxic effect*" (emphasis added). This would not suggest the default approach of adding all hazard quotients. Hazard quotients should be added to develop a hazard index if two or more chemicals affect the same target organ and produce the same toxic effect. The assumption of general additivity between chemicals is arbitrary and overly conservative. In addition, it can be misleading if the hazard quotients are added but the toxicity test endpoints for each toxicity reference value are not the same. The concept of antagonistic effects between chemicals was addressed in a qualitative manner in the Draft EIS as part of the weight of evidence discussion and risk characterization. The concept of chemical antagonism was not applied in a quantitative manner. In the absence of a toxicological basis for the additivity of toxic effects between two or more chemicals, calculating a hazard index is unfounded and was not applied in the final risk assessment.

03-08

Skorupa and Ohlendorf (1991) provide concentrations of selenium in water associated with accumulation of selenium in the eggs of eared grebes (*Podiceps nigricollis*) to toxic threshold levels. Skorupa and Ohlendorf (1991) list behavioral and ecological variables affecting the maximum accumulation of selenium from water into eggs. They also provide the life history characteristics of the eared grebe which make it likely to realize the full potential for bioaccumulation of selenium. Because of differences between eared grebes and mallards in these critical life history characteristics, toxic thresholds for eared grebes were not used as a direct substitute for toxic thresholds for mallards in the risk assessment. Instead, the specific feeding behaviors of mallards were used to calculate dose to mallards, and the dose was compared to a dietary threshold for the pit lake risk assessment. Skorupa and Ohlendorf (1991) remark that the dietary threshold resulting in bioaccumulation of selenium in eggs to toxic thresholds in eared grebes is consistent with the dietary threshold reported by Heinz et al. (1989) for mallards. The Heinz et al. (1989) study was used as the basis for the selenium screening evaluation and risk estimate. Skorupa and Ohlendorf (1991) was consulted, but was not directly applicable to the ecological risk assessment.

Boron concentrations in the Round Mountain pit lake would be the result of boron releases from oxidized wall rock or boron loaded by inflowing ground water. Boron was not detected (detection limit=10 milligrams/kilogram) in any of the acid-extractable metals analyses performed on 116 samples selected to represent the lithologies present in the ultimate pit surface of the Round Mountain pit lake, indicating that boron would not be released in significant amounts from oxidized wall rock in the pit.

Response to Letter 3

Historically, ground water at the Round Mountain mine has not been analyzed for boron because it is not one of the analytes on the Nevada Division of Environmental Protection Profile I or II analyte lists. However, on December 7, 1995, two new wells (one each in the Paleozoic metasediments and the Tertiary volcanics) were sampled, and the waters were analyzed for boron. The waters contained 0.31 and 0.33 milligrams per liter of boron, respectively. Conservative (i.e., non-reactive) constituents that evaporatively concentrate in the pit lake (e.g., chloride) are predicted to increase by a factor of approximately 5 over the first 330 years after the cessation of mining. Assuming that boron behaves conservatively, the boron concentration in the lake at 330 years after mining can be expected to be approximately 1.5 milligrams per liter, well below the Nevada Division of Environmental Protection standard of 5 milligrams per liter for propagation of wildlife.

Furthermore, boron will probably not behave conservatively. Boron has been shown to be removed from solution by precipitation with aluminum, iron, and silica. Boron also has been shown to adsorb to aluminum and iron oxides and clay minerals, with maximum sorption occurring between pH 7.5 and 10 (Rai and Zachara[12]). Therefore, at the predicted pH of the lake, boron can be expected to be attenuated to some extent, and concentrations would be lower than 1.5 milligrams per liter.

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[12] Rai, D., and J.M. Zachara. (1986). Chemical Attenuation Rates, Coefficients, and Constants in Leachate Migration. Volume 1: A Critical Review. Report prepared by Battelle, Pacific Northwest Laboratories, Richland Washington, for the Electric Power Research Institute, Palo Alto, California. EA-3356.

03-09

Section 3.2, Water Resources, and Section 3.5, Wildlife and Fisheries Resources, of the Final EIS have been revised to reflect humidity cell test data from the Round Mountain mine. The new data did have an effect on predictions of water quality in the pit lake as well as predictions of impacts to wildlife that would result from pit lake water quality. In addition, the screening-level methodology for the risk assessment has been revised, and these changes are reflected in Section 3.5. The revised risk assessment report has been provided to the U.S. Fish and Wildlife Service and the Nevada Division of Wildlife.

Letter 3 Continued

Specific Comments

3-10 Page 9, Selection of Receptor Species: The risk assessment assumes that fish will not be present in the pit lake, and, therefore, does not consider fish consumption as a potential exposure pathway. The Nevada Division of Wildlife has stated that there is a high probability that fish will be introduced into the pit lake at some point in the future. Regardless of whether this stocking is legal or illegal, the model should assume that the pit lake will contain fish, and that consumption of fish by wildlife could occur. This pathway, along with appropriate receptor species should be included in the risk assessment.

3-11 Page 11, Table 1: The definition provided for bioaccumulation factor (BAF) on this page, and the definition of bioconcentration factor (BCF) presented on pages 27 and 32 seem to have been interchanged. Bioaccumulation has been defined as the net accumulation of a chemical by an organism as a result of uptake from all routes of exposure. Bioconcentration has been defined as the net accumulation of a chemical directly from aqueous solution by an aquatic organism (Suter 1993). BAF is a unitless value, while BCF can be defined in terms of the ratio of volume of water to weight of organism (ml/g), or converted to a unitless proportionality constant (Barron 1995). The Service believes that BAF and BCF are two substantially different phenomena that should not be intermixed. In developing these values for use in the model, if BAF and BCF were reported directly from the scientific literature, the appropriate definitions should be applied in the text of the risk assessment. However, if these values were calculated or extrapolated from data presented in the scientific literature, these values should be recalculated using the appropriate assumptions and techniques.

3-12 Page 27, Calculation of Chemical Intake: Killdeer are reported to obtain only 10 percent of their diet from areas around the pit lake [F(ih) = 10 percent]. From where does the risk assessment assume killdeer obtain the remaining 90 percent of their diet?

3-13 Page 28, Table 9: Please describe how mean chemical concentrations were developed when less than 50 percent of the samples reported detectable concentrations. Also, what value was used for non-detected data points?

3-14 Page 32, Bioconcentration Factors, Arsenic: The discussion for arsenic incorrectly interchanges two biochemical processes. "Detoxification" is the process whereby a compound (arsenic) is chemically transformed into a "non-toxic" (not "less toxic") form. "Depuration" is the process whereby a compound is excreted or otherwise removed from an organism, be it in a toxic or non-toxic state. Therefore, arsenic methylation would be a detoxification mechanism, but the fact that methylated arsenic can be quickly cleared from all tissues is a depuration mechanism.

Response to Letter 3

03-10 The consumption of fish by wildlife was not evaluated for the Final EIS because the closure of the open pit includes installation of a 8-foot chain link security fence around the perimeter of the pit lake, with 2 feet of barbed wire at the top of the fence. A 5-to-8-foot berm would surround the fence. The fence and berm would prevent access by people that would stock the pit lake with sport fish. Because there are no surface inflows or outflows to the pit lake, fish are not expected to otherwise gain access to the pit lake.

03-11 The typographical error in Table 1 of PTI's risk assessment[7], in which the bioconcentration factor was mistakenly referred to as the bioaccumulation factor, has been corrected in the final risk assessment.

03-12 Killdeer derive the majority of their food from upland sources, including terrestrial invertebrates and plants (Baldassarre and Fischer[13]). These food sources would not be affected by the pit lake.

[13] Baldassarre, G.A., and D.H. Fischer. (1984). Food habits of fall migrant shorebirds on the Texas high plains. *J. Field Orinthol.* 55(2)220-229.

03-13 Several types of data (e.g., ground water, humidity cell leachate, Meteoric Water Mobility Procedure data) were used to predict the water quality in the pit lake, and in many cases, analytical data were reported as "below the detection limit." For samples with no detectable concentrations, a value equal to half the detection limit was substituted prior to estimating the pit lake water quality or calculating the mean. Although there is no statistical regulatory guidance for predicting future pit lake water quality, the substitution of half the detection limit is consistent with EPA's guidance for the statistical analysis of ground water monitoring data at Resource Conservation and Recovery Act facilities (EPA[14]). The text of PTI's technical report entitled Predicted Water Quality in the Round Mountain Gold Company Pit Lake[4] was revised to ensure a clear presentation of the methods used for below-detection-limit data.

[14] EPA. (1989). Statistical analysis of ground water monitoring data at RCRA facilities: Interim final guidance. EPA/530-SW-89-026. Washington, D.C.

03-14 This error has been corrected in the ecological risk assessment.

Letter 3 Continued

3-15 Page 36, Mercury, Birds: The section for birds states that a NOAELt of 0.5-ppm (mg/kg) was established in the referenced scientific study. This value was then translated into LOAELt value of 0.064-mg/kg (ppm). This is illogical as a NOAEL value cannot be greater than a LOAEL value.

3-16 Page 43, Use by Wildlife Populations: The text describing wildlife behavior and use of water sources in a semi-arid desert is misleading. Commonly in semi-arid deserts, wildlife abundance, diversity, and density are highest around any water sources, including springs, seeps, creeks, ponds, and lakes. The Service recommends the text be changed to indicate that the pit lake will be an attractant to most species of wildlife in the area, with access to the lake being the primary mitigation to that attraction.

3-17 Appendix D: The first table should include a column for the aquatic life, 30-day average standard for these elements.

ENVIRONMENTAL IMPACT STATEMENT

General Comments

3-18 Section 3.5.2.1 includes an abbreviated discussion of the risk assessment performed for the pit lake. Several of the general and specific comments made for the risk assessment above are common to the DEIS. Please ensure that changes in the risk assessment are accurately reflected in the text of the DEIS.

Ecological risk assessments were designed to be used as a decision-making tool at hazardous waste sites. Ecological risk assessments predict which element(s) is most likely to cause an adverse effect to a specific receptor through a specific pathway. Managers at such sites can take this information and make project management decisions to minimize the potential for, or magnitude of the predicted impact(s) to the environment. If elimination or minimization of predicted impacts proves improbable, the information presented in the risk assessment can be used to guide mitigation efforts to offset the predicted impacts. The risk assessment performed for this project currently predicts impacts, primarily to mallards, resulting from poor water quality in the pit lake. Section 3.5 of the DEIS discusses the risk assessment in depth, including the predicted adverse effects to the environment, yet there are no mitigation or monitoring proposals based on the risk assessment included in the DEIS. The Service

3-19 recommends that the results of the risk assessment should be carefully examined to determine what scenarios result in adverse impacts to the environment, including the potential for fish to be present in the lake, and base management and/or mitigation decisions on this information in an effort to eliminate or offset these impacts.

During presentations at the October 18, 1995, meeting, the Service learned that new ground water quality data had become available subsequent to the release of the current version of the risk assessment. It was stated at this meeting that the new data would have a substantial effect

Response to Letter 3

03-15 Heinz[15] reports doses to test animals as a concentration of the chemical in the diet in parts per million, or milligrams per kilogram in food. This measure of dose has to be converted to milligrams per kilogram body weight-day to be comparable with the dose estimated using the food web model. For this conversion, the concentration in the food (0.5 parts per million or 0.5 milligrams per kilogram) is multiplied by the ingestion rate of the test species (0.128 kg/day) and divided by the body weight of the test species (kilograms). In the case of the mallards in Heinz's study, the calculation is as follows:

[0.5 milligram Hg/kilogram food x 0.128 kilogram food/day] / 1 kilogram body weight =

0.064 milligram Hg/kilogram body weight-day

Body weight and food ingestion rate are provided for each toxicity reference value in both the draft and final risk assessments.

[15] Heinz, G.H. (1979). Methyl mercury: reproductive and behavioral effects on three generations of mallard ducks. *J. Wildl. Mgmt.* 43:394-401.

03-16 The language has been changed in the final report to indicate that waterfowl and small mammals may be attracted to the pit lake.

03-17 Appendix D has been removed from the final risk assessment, but comparison of predicted concentrations to aquatic life criteria does appear in the text of the final risk assessment. The chronic, 4-day average criteria concentration was used. The "aquatic life, 30-day average standard" concentration was not known.

03-18 Changes discussed in response to previous comments have been incorporated into the Final EIS.

03-19 Please see the response to comment 01-01 relative to mitigation based on the ecological risk assessment. The potential for fish to be present in the pit lake has been removed by the pit closure plan, which is described in Section 2.3.7.3 (pages **2-25 and 2-26**) of the Final EIS.

Letter 3 Continued

on predictions of water quality in the pit lake, and the subsequent evaluation on risk to natural resources posed by the pit lake. The Service believes that any mitigation plan developed in response to potential impacts related to pit lake water quality be based on the most complete prediction of those impacts available. As the Service has not had the opportunity to review the latest water quality predictions, or the ecological risk assessment based on the new predictions, the Service reserves comment on potential mitigation proposals until such time that this information has been made available for review and comment.

3-20 A substantial amount of text in the risk assessment and DEIS is dedicated to the discussion of uncertainties in a number of assumptions and methodologies used in the modeling processes performed to complete this project. Included in this text are discussions of assumptions used for the groundwater model, pit lake water quality model, and the potential for aquatic communities to become developed in the pit lake, among others. It would seem prudent that, given this level of uncertainty, the DEIS would call for monitoring of these assumed parameters to ensure that predictions made in the risk assessment remain reliable and accurate. This type of monitoring would provide project managers timely information should any of the predictions be proven incorrect, and potentially result in unforeseen impacts.

Summary Comments

3-21 The Service requests that the ecological risk assessment be rerun using the ground water quality data which were presented at the October 18, 1995, meeting with Bureau staff. Additionally, the Service requests that assumptions and methodologies discussed in our general and specific comments to the risk assessment be modified to improve the reliability of predictions made by the risk assessment. The Service requests that these results be made available for review and comment before release of the Final EIS. Only after an evaluation of the predicted impacts associated with this project will the Service be able to evaluate, comment on, and/or provide mitigation strategies to offset these impacts.

Please contact John Miesner or Stanley Wiemeyer at (702) 784-5227 if you require additional information.

Carlos H. Mendoza

Response to Letter 3

03-20 The Nevada Division of Environmental Protection requires mining companies to conduct up to 30 years of postclosure monitoring of pit lakes. At this time, however, there is no requirement to monitor the biota or ecological risk assessment predictions at the mine after closure.

03-21 The ecological risk assessment was revised using new ground water quality data and a revised set of assumptions and methodologies. See Section 3.5 of the Final EIS and the response to comment 03-09.

cc:
Administrator, Nevada Division of Environmental Protection, Carson City, Nevada
Administrator, Nevada Division of Wildlife, Reno, Nevada
Assistant Regional Director, Interior Basin Ecoregion, Fish and Wildlife Service, Portland, Oregon
Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Portland, Oregon (Attn: Merle Richmond)

References

Barron, M. G. 1995. Bioaccumulation and bioconcentration in aquatic organisms. Pages 652-666 in D. J. Hoffman, B. A. Rattner, G. A. Burton, and J. Cairns Jr. (eds.) Handbook of ecotoxicology. Lewis Publishers, Boca Raton, Fla.

Skorupa, J. P., and H. M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds. Pages 345-368 in A. Dinar and D. Zilberman (eds.) The economics and management of water and drainage in agriculture. Kluwer Academic Publishers.

Suter, G. W. 1993. Ecological risk assessment. Lewis Publishers. 538 pp.

Letter 4

PETER G. MORROS, Director

L.H. DODGION, *Administrator*

(702) 687-4670
TDD 687-4678

Administration
Mining Regulation and Reclamation
Water Pollution Control
Facsimile 687-5856

Address Reply to:
Capitol Complex
Carson City, NV 89710

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Governor

Waste Management
Corrective Actions
Federal Facilities
Facsimile 885-0868

Air Quality
Water Quality Planning
Facsimile 687-6396

Located at:
333 W. Nye Lane
Carson City, NV 89710

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Capitol Complex
Carson City, Nevada 89710

November 22, 1995

Mr. Christopher Stubbs
EIS Project Manager
Battle Mountain District
Bureau of Land Management
P.O. Box 1420
Battle Mountain, Nevada 89820

Re: DEP # 96-030 SAI 96300045 (N65-87-003P, 1793/3809, (NV-932.8), (NV-060/065))

Dear Mr. Stubbs:

The Nevada Division of Environmental Protection has conducted a Clearinghouse review of the Draft EIS for the Round Mountain Mill and Tailings Facility. Attached are comments from the Bureau of Mining Regulation and Reclamation regarding the aforementioned proposal. These concerns focus on the adequacy of the pit lake study.

If you have any questions please feel free to contact me at 687-4670, ex 3118.

Sincerely,

David R. Cowperthwaite

David R. Cowperthwaite
NDEP Clearinghouse Coordinator

cc: State Clearinghouse/w/attachments

telefaxed 11-22-95

Letter 4 Continued

Bureau of Mining Regulation and Reclamation

Interoffice Memo

Date: November 17, 1995

To: David Copperthwaite

From: David Gaskin Doug Z for DG

Subject: Comments on Draft Environmental Impact Statement, Round Mountain Mill and Tailings Facility, September 1995.

4-1 The pit lake study in the Round Mountain Draft EIS indicates that short-term water quality may have the potential to affect adversely the health of avian life, in particular due to arsenic levels above 1.0 mg/L. However, it is recognized that there is some uncertainty involved with the modeling process, especially over the long term. As the mining proceeds, additional refinements will be made to the model input assumptions and the prediction process, allowing more accurate forecasts of the future lake quality.

For pit lakes, the operator is required to comply with NAC 445A.429, which states:

> Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which:
> (a) Has the potential to degrade waters of the state; or
> (b) Has the potential to affect adversely the health of human, terrestrial or avian life.

Should refined predictions show a strong possibility of violating NAC 445A.429 in the short term, the operator would be required to propose and evaluate possible mitigation measures.

Response to Letter 4

04-01 Current modeling is based on the best available technology. However, as technology improves and additional data become available from monitoring programs required by the Nevada Division of Environmental Protection, remodeling would be considered should significant changes be noted.

Letter 5

BOB MILLER
Governor

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WILDLIFE
1100 Valley Road
P.O. Box 10678
Reno, Nevada 89520-0022
(702) 688-1500 • Fax (702) 688-1595

PETER G. MORROS
Director
Department of Conservation and Natural Resources

WILLIAM A. MOLINI
Administrator

Region III III-96-036
State Mailroom Complex
Las Vegas, Nevada 89158
November 14, 1995

Ms. Julie Butler, Coordinator
Nevada State Clearinghouse
Department of Administration
Capitol Complex
Carson City, NV 89710

Re: Round Mountain Mill and Tailings Facility Draft Environmental Impact Statement (SAI #96300045)

Dear Ms. Butler:

The Nevada Division of Wildlife (Division) thanks you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) for Round Mountain Gold Corporation's (RMGC) proposed Mill and Tailings Facility at the Smoky Valley Common Operation (SVCO). Upon agency review of the DEIS, and the accompanying pit lake study, a number of concerns have been raised.

5-1 1. Round Mountain Gold Corporation will be required to obtain an Industrial Artificial Pond Permit from the Division, to operate the mill and tailings facility. Applications can be obtained from the Division's Tonopah office at (702) 482-3153.

5-2 2. RMGC states that the mill tailings will be neutralized, and non-toxic to wildlife. Tailings impoundments are prone to spikes in cyanide concentrations (i.e., elevated levels of cyanide). How does RMGC plan to monitor the cyanide levels to prevent the presence of chemical concentrations harmful to wildlife?

5-3 3. The only mention of fencing for the impoundment, is a five-strand barbed wire fence. This is not adequate to preclude wildlife. Large and small mammals can easily gain access through and over a fence of this design. There is no mention of exclusionary measures for the reclaim ponds (i.e., fencing, floating HDPE balls, netting, etc.) Though the facilities are expected to be neutral, numerous species could become mired or drown in the impoundment and ponds. The installation of wildlife escape ramps may alleviate the potential for drowning victims. However, these ramps are not sufficient without the advent of adequate wildlife fencing. These ramps would encourage repeated wildlife use of solution bearing the potential to have lethal cyanide levels.

5-4 4. The DEIS claims that no threatened or endangered wildlife will be impacted by the project. This may be true at present time, but the mine will have a lingering impact to the environment and could impact sensitive species that are not yet listed. The tailings impoundment will act as a magnet for wildlife, attracting a variety of species. It should be noted, that candidate species have been

Response to Letter 5

05-01 The SVCO will submit an application for an Industrial Artificial Pond Permit following the BLM's approval of the Plan of Operations and issuance of the Record of Decision, which will determine the final tailings impoundment design.

05-02 Cyanide is added to a concentrate, which comprises approximately 5 percent of the mill feed weight. After leaching, this material passes through a cyanide neutralization process. The neutralized concentrate is sampled at regular intervals during processing for residual cyanide. The neutralization process is then adjusted as required to keep the solution non-toxic to wildlife. The concentrate is recombined with the remaining mill feed for a dilution of 19:1. The combined slurry is pumped to the tailings pond and mixed with the existing contents of the tailings pond for additional dilution. The tailings pond solutions are sampled for residual cyanide at periodic intervals during the month.

05-03 The five-strand barbed wire fence is the perimeter fence around the permitted property boundary. The tailings impoundment and reclaim ponds would be fenced with a 6-foot chain link fence with 2 additional feet of barbed wire, for a total height of 8 feet. The text in Section 2.3.7.3 **(page 2-25)** of the Final EIS has been revised to reflect this fencing.

05-04 A statement relative to these candidate species being observed in or near the area has been added in Section 3.5.1.2 **(page 3-80)** of the Final EIS. The potential impact to these species has been addressed in Section 3.5.2.1 **(page 3-92)** of the Final EIS.

Letter 5 Continued

5-4 observed in or near Big Smoky Valley: White-faced Ibis *(Plegadis chihi)*, Ferruginous hawk *(Buteo regalis)*, and Western snowy plover *(Charadrius alexandrius nivosus)*. The species were observed at SVCO's rapid infiltration basin, the west entrance to Hunt's canyon in the Toquima Range, and Sailor Lake, respectively.

5-5 5. In the reclamation section, "wildlife grazing" is designated as a post mine land use. A more appropriate term is "wildlife habitat". Grazing is a feeding strategy utilized by some species, and not indicative of a broad spectrum of wildlife habitat use.

5-6 6. The reclamation seed mix has a heavy component of non-native wheatgrasses. These species are not represented in the surrounding habitat, and will encourage visual disparity of the reclaimed slopes from the adjacent habitat. The Division suggests removing or reducing these species in the mix, and using a heavier component of the grasses found in the surrounding habitat (i.e., Galleta, Indian ricegrass, and Bottlebrush squirreltail). The Division also recommends adding all of the proposed alternative species to the mix. Rubber rabbitbrush (Chrysathamnus nauseaosus) is not needed in the mix, as it is expected to come in readily on its own.

5-7 7. Reclamation of the area should include topography which would enhance wildlife habitat. Provision for rock piles and/or raptor perches would encourage small mammals, reptiles and several species of avian wildlife.

5-8 8. A severe overgrazing problem is detailed in the range management alternative of the DEIS. With or without the tailings impoundment, this issue needs to be addressed. Permanent damage to the resource is not acceptable. The cattle should be reduced in number, redistributed, or removed from the damaged corridor.

5-9 9. The DEIS indicates that legal hunting pressure would not increase, but higher poaching rates are expected to occur. This premise is false, because legal fishing and hunting of upland game (including sage grouse and chukar), waterfowl, and furbearing mammals can be expected to increase. Employees who hunt should be encouraged to attend a hunter education course, to facilitate responsible and ethical hunting by those individuals.

5-10 10. The pit lake risk assessment conducted by PTI for RMGC, is conservative in nature. However, some of the assessment assumptions may require reevaluation: The first premise being, that transitional vegetation and aquatic insects will not develop in the first 160 years (short term), and wildlife will utilize the lake only as a water source. The Division believes the pit lake will have the ability to support vegetation and insects in the short term period. The risk assessment should be modeled to include food (vegetation and insects) as an ingestion route for this time frame. It is assumed that no fish will be present in the pit lake. The lake will have the potential to support aquatic life, and the human desire to plant fish will be high. Thus fish and other aquatic life should be included in the risk assessment. PTI used water samples from several wildlife management areas to determine background concentrations of contaminants. PTI makes the assumption that these waters are not contaminated by human activities. This supposition is false. The water in these management areas is impacted by agricultural use, returning the water to the system after irrigation of farmlands. The Division suggests using water sources in the adjacent mountain ranges or Big Smoky Valley for comparison.

5-11 11. PTI concluded that the pit lake may impact waterfowl populations. The risk assessment showed the formation of vegetation on a bench 8' below the expected lake elevation, which would provide a contaminated food source for mallards. The Division would recommend RMGC and BLM strongly consider removing this bench.

Response to Letter 5

05-05 Wildlife grazing has been changed to wildlife habitat in Section 2.3.6.1 **(page 2-21)** of the Final EIS.

05-06 One of the primary goals of reclamation is to reduce soil erosion. The seed mix needs to contain species that will establish quickly and effectively. The wheat grasses were included in the mix because they have established well on the lost plots at the Round Mountain Mine. This is also the reason rubber rabbitbrush was included in the seed mix. The native grass species mentioned by the Division of Wildlife are also included in the seed mix even though they are more difficult to grow than the wheat grasses.

The area that the Round Mountain Mine will be reclaiming is a hill above the valley floor. Native vegetation on hillsides is often different from the surrounding valley floor. Thus, a visual contrast between the reclaimed area and the valley floor is likely inevitable.

The seed mix as it exists is extensive; it is not necessary to add alternative species.

05-07 The SVCO is incorporating rock piles and raptor perches into the reclamation of the site. The topography will be varied to the extent possible based on site-specific conditions.

05-08 Closing off the cattle corridor in question is described in Section 2.4.1.1 of the Draft EIS and Final EIS, Range Management Alternative. This alternative is also the Agency Preferred Alternative (see Section 2.6, **page 2-39**) of the Final EIS, indicating that the BLM intends to select this alternative for implementation in the Record of Decision. In the event that a Record of Decision is not signed and the project is not permitted, the BLM would explore closing the cattle corridor through other types of authorizations.

05-09 The State regulates legal fishing and hunting by the issuance of licenses, which would increase as noted except for "draw permits" on big game; the proposed project would not adversely affect legal fishing and hunting but poaching could increase. Hunter safety classes, sponsored by local sporting goods stores, are given locally. The Smoky Valley Common Operation posts notifications of these classes.

05-10 In the final risk assessment, both the screening for chemicals of concern and the food web model assume that dabbling ducks and other birds will use the lake for breeding habitat. Ingestion of food organisms from the pit lake by receptors has been included as part of the exposure regime of all receptors for all periods modeled in the risk assessment, beginning at approximately 66 years after mining.

It is assumed that fish will not be present for the final risk assessment and EIS; please see the response to comment 3-10.

The comparison of pit lake water quality to reference area lakes has

Letter 5 Continued

5-12 12. As the pit lake is expected to exceed state water quality standards, it is recommended that terrestrial mammals (including humans) be excluded from the lake. Fencing the pit, and blasting or trenching the entrance ramp are possible alternatives for exclusion.

Thank you for seeking the Division's involvement for this DEIS. The Division is happy to enter a dialog on any of these issues. Please contact the Tonopah office at 702/482-3153 if you have any queries or comments.

Respectfully,

Cornelio O. Padilla
Supervising Biologist-Habitat

cc: Habitat Bureau Chief
Habitat - Tonopah
Game - Las Vegas, Tonopah
BLM - Chris Stubbs, Battle Mountain
Round Mountain Gold - Shirley Badame

Response to Letter 5

05-11 Please see the response to comment 01-01 regarding the use of the ecological risk assessment to evaluate mitigation measures.

05-12 The pit lake would be fenced by an 8-foot chain link security fence with 2 additional feet of barbed wire, creating a 10-foot high fence. The access ramp would be blasted at the completion of the Nevada Division of Environmental Protection's monitoring requirements. Section 2.3.7.3 **(pages 2-25 and 2-26)** of the Final EIS has been revised to reflect this fencing.

Letter 6

STATE OF NEVADA
DEPARTMENT OF MUSEUMS, LIBRARY AND ARTS
STATE HISTORIC PRESERVATION OFFICE
Capitol Complex
100 Stewart Street
Carson City, Nevada 89710

BOB MILLER
Governor

JOAN G. KERSCHNER
Department Director

RONALD M. JAMES
State Historic Preservation Officer

October 10, 1995

Christopher Stubbs
EIS Project Manager
Bureau of Land Management
Battle Mountain District Office
P.O. Box 1420
Battle Mountain NV 89820

RE: Draft Environmental Impact Statement (EIS), Round Mountain Mill and Tailings Facility, Big Smokey Valley, Nye County. Nevada Clearinghouse Number: SAI #96300045 Due 10/10/95

Dear Mr. Stubbs:

The Nevada State Historic Preservation Office (SHPO) reviewed the Draft EIS for the subject undertaking.

The SHPO notes that the BLM has used the words "project area" to describe two distinctly different regions:

> The title of one table (3-28; pages 3-99 through 3-103) is "National Register of Historic Places Status of Cultural Resources Within the Project Area" [emphasis added]. This table indicates that four eligible properties are located within the project area.
>
> The "Proposed Action" section (3.8.2.1) of this document states that none of the sites within the proposed project area are eligible for the National Register of Historic Places.

According to phone conversation with Ms. Pat Hicks on October 10, 1995, none of the sites within the proposed project area are eligible for the National Register of Historic Places.

6-1 The SHPO recommends that the BLM define the phrase "project area" to avoid any possible confusion in the final EIS.

If you have any questions concerning this correspondence, please feel free to call me at (702) 687-5138.

Sincerely,

Rebecca Lynn Palmer
Archaeologist

Response to Letter 6

06-01 A reference to Figure 2-5 has been added to help identify the project area in Section 3.8.1.1 of the Final EIS **(page 3-100)**. Table 3-28 identifies all cultural resources identified within the project area. The text in Sections 3.8.2.1 through 3.8.2.4 of the Final EIS **(page 3-111)** has been revised to indicate that no sites within the area of disturbance for the proposed action or the project alternatives are eligible for the National Register of Historic Places.

Letter 7

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OCT 12 1995
DEPARTMENT OF ADMINISTRATION
CARSON CITY, NEVADA

NEVADA STATE CLEARINGHOUSE

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95 SEP 21 AM 10:42
STATE ENGINEERS OFFICE

Department of Administration
Planning Division
Blasdel Bldg., Rm 200
(702) 687-4065
fax (702) 687-3983

DATE: September 19, 1995

Governor's Office	Legislative Counsel Bureau	Conservation-Natural
Nuclear Projects Office	Communications Bd.	Resources
Business & Industry	Emp. Training & Rehab.	**Director's Office**
Agriculture	Research Division	**State Lands**
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Human Resources	UNLV Library	State Parks
Aging Services	**Wild Horse Commission**	**Water Resources**
Health Division	**Historic Preservation**	Water Planning
Colorado River Commission	Emergency Management	**Natural Heritage**
	Washington Office	

Nevada SAI # 96300045

Project: Round Mountain Mill and Tailings Facility

CLEARINGHOUSE NOTES:

Enclosed, for your review and comment, is a copy of the above mentioned project. Please evaluate it with respect to its effect on your plans and programs; the importance of its contribution to state and/or local areawide goals and objectives; and its accord with any applicable laws, orders or regulations with which you are familiar.

Please submit your comments no later than **October 10, 1995** Use the box below for short comments. If significant comments are provided, please use agency letterhead and include the Nevada SAI number and comment due date for our reference.

THIS SECTION TO BE COMPLETED BY REVIEW AGENCY:

___No comment on this project	___Conference desired (See below)
___Proposal supported as written	___Conditional support (See below)
X Additional information below	___Disapproval (Explain below)

AGENCY COMMENTS:

7-1 The 400 gpm estimated evaporative loss from the pit after closure is a permanent appropriation of the public waters of the State of Nevada. The evaporation from the pit reduces the total available water for beneficial use in this basin.

Michael J. Anderson 10/10/95
Hydraulic Engineer III, Water Resources

Response to Letter 7

07-01 The permanent reduction in the total water available due to evaporative loss from the pit lake is addressed in Section 3.17, Irreversible and Irretrievable Commitment of Resources, in the Draft EIS and Final EIS. With respect to water rights, the SVCO currently has water rights for wells that provide water for mineral processing and other operational needs and pit dewatering. At the cessation of mining and mineral processing activities and pit dewatering, the SVCO intends to modify the point of diversion from one or more water supply wells and/or dewatering wells to account for the permanent evaporative loss from the pit lake. This discussion has been added to Section 3.17.2 **(page 3-176)** of the Final EIS.

Letter 8

NYE COUNTY

RECEIVED
MAIL ROOM
1995 NOV 27 P 2:1[illegible]

November 21, 1995

Mr. Mike Mitchell, Acting District Manager
BLM - Battle Mountain District
P.O. Box 1420
Battle Mountain, NV 89820

Dear Mr. Mitchell:

Subject: Nye County's Comments Relative to the Round Mountain Mill and Tailings Facility Draft Environmental Impact Statement

At the Nye County Board of County Commissioners' November 21, 1995 meeting we reviewed the document entitled *Draft Environmental Impact Statement - Round Mountain Mill and Tailings Facility* dated September 1995 and offer the following comments.

8-1 As you are aware Nye County has a place at the table when an issue of this nature is presented to the BLM and we have been guaranteed on numerous occasions that we would be asked to participate long before the public scoping process is announced. In this case an invitation was not extended to us until November 2, 1993 when we received a fax of an unsigned document entitled *Intent to Prepare an Environmental Impact Statement and Notice of Scoping Period and Public Meetings*. This document announced meetings held on November 9 and 10, 1993 - one short week after the fax was received. This type of participation is not what is intended according to your own regulations and should it happen again we will take whatever measures are necessary.

8-2 In addition to our concern of not being made a partner early in the process we are also concerned that the requirement to prepare an EIS goes entirely beyond reason. Found on page 1-1 of the EIS is the statement. "Because of the potential for the proposed project to result in significant environmental impacts, the BLM determined that an environmental impact statement (EIS) would be necessary." Who in the BLM made this costly decision and where exactly are the significant environmental impacts? This is the reason Nye County is entitled to be present early in the process when these types of decisions are made. In speaking with mine officials we found that the cost of preparing the EIS is approaching $1,000,000 - money that could have better benefitted the community.

COUNTY OF NYE • P.O. BOX 153 • TONOPAH, NEVADA 89049 • (702) 482-8191

Response to Letter 8

08-01 The BLM made extensive efforts to involve Nye County in preparing and reviewing the Round Mountain Mill and Tailings Facility EIS. The BLM held open, well-advertised public scoping meetings on November 9 and 10, 1993, one of which was at Hadley in Nye County; the Nye County Board of Commissioners received a specific invitation to this meeting. On December 7, 1993, the BLM and Round Mountain Gold Corporation briefed the Board of Commissioners on the Round Mountain project in the Commissioners' Chambers. Prior to this presentation, a detailed briefing paper was sent to the Board of Commissioners so the commissioners would be informed of and be able to discuss the issues to be covered in the EIS. In May 1994, a copy of the EIS Preparation Plan was sent to the Nye County Board of Commissioners for review and comment and to keep the commissioners apprised of the progress of the EIS. The Commissioners also received, in June 1994, a newsletter describing the status of the project. More recently, the Board of Commissioners received a specific invitation to the Draft EIS Comment meetings on October 17 and 18, 1995 (one meeting was held in Nye County). Finally, the Commissioners were recently offered a meeting between Nye County, the BLM, and Round Mountain Gold Corporation to discuss issues relative to the preparation of the Final EIS.

The BLM will continue to keep the Nye County Board of Commissioners apprised and informed of the progress of the Round Mountain Mill and Tailings Facility EIS and is amenable to meeting with Nye County officials to discuss any issues related to this project.

08-02 The BLM's Nevada State Director and Battle Mountain District Manager made the decision to prepare an EIS for this project. This decision was made with the full concurrence of Round Mountain Gold Corporation.

When a proposed project has the potential for significant impacts to the quality of the human environment, an EIS must be prepared. At the inception of this project, it was determined that the potential for significant impacts existed, although the specific impacts were undetermined. The ecological risk assessment conducted for the EIS concluded that there may be impacts to individual waterfowl as a result of exposure to zinc in the pit lake, but population-level impacts are unlikely (see Section 3.5.2 of the Final EIS). Although there are uncertainties associated with the ecological risk assessment's prediction of zinc concentrations, there is a potential for significant wildlife impacts.

Letter 8 Continued

8-3 Many of the impacts to the environment discussed in the EIS are going to occur whether the expansion takes place or not and should not have been addressed. Cases in point are the expansive studies and modeling concerning water quality and quantity. We feel it to be a waste of time and money to study water 330 years into the future when the proposed amendment has absolutely nothing to do with the pit water quality and quantity. The pit is going to be there regardless of the expansion. A second case is the analysis and reporting of studies of the existing leach offload piles. As you are aware Round Mountain Gold Corporation was required, by the Nevada Division of Environmental Protection, to conduct extensive studies related to the offload piles in order to amend its discharge permit to ensure groundwater would not be polluted. For you to require that these existing studies be written into the EIS is costly and redundant.

8-4 Although we have voiced the above concerns we did review the document. As you are aware mining is a part of established custom and culture in central Nevada. We are in support of the continued operation and expansion of the Round Mountain mining facilities. Round Mountain Gold Corporation has been a good neighbor to the Smoky Valley area residents as well as Nye County and we are confident that they will continue to be.

Sincerely,

NYE COUNTY BOARD OF COMMISSIONERS

Cameron McRae, Chairman

Bill Copeland, Member

Richard Carver, Vice Chairman

W. Wayne Perkins, Member

Red Copass, Member

cc: Mr. Chet Diercks, Round Mtn Gold Corporation
Ms. Ann Morgan, BLM - Nevada State Director
Nye County Board of County Commissioners
Mr. William L. Offutt, Nye County Manager
Mr. Ron Williams, Acting Planning Director

B:\95112102.LTR

Response to Letter 8

08-03 Potential environmental impacts resulting from mine dewatering, pit water quality, and the leach offload piles were not addressed in environmental assessments for past expansions at the Round Mountain mine site. These impacts have not previously been analyzed or reported to the public and other agencies through the National Environmental Policy Act (NEPA) process. Therefore, the decision was made to include impact analyses of dewatering, pit water quality, and the leach offload piles in this EIS in order to meet the procedural provisions and regulatory requirements of NEPA.

08-04 Comment noted.

Letter 9

SIERRA CLUB

Toiyabe Chapter – Nevada and Eastern California

Nov. 21, 1995

Christopher Stubbs, EIS Project Manager
Bureau of Land Management
Battle Mountain District
P.O. Box 1420
Battle Mountain, NV 89820

RE: ROUND MOUNTAIN MILL AND TAILINGS FACILITY EIS

Dear Mr. Stubbs:

These comments are submitted on behalf of the Toiyabe Chapter of the Sierra Club on the EIS indicated above. We appreciate the opportunity to provide both oral and written testimony on this EIS. These comments are in addition to the oral comments presented at the EIS hearing in October in Reno.

This is a very large mine and constitutes a permanent impact on Big Smokey Valley. We recognize the strong local support for the mine and the very positive economic impact it has had, and will continue to have on persons who are employed in the mine and others who realize the benefits from the economic stimulation due to the mine. However, it is also the case that mining activity will very likely be gone within 1-3 decades, but the surface and water impacts will last for decades and centuries. This is the first large gold mine for which the modeling data predict the generation of a pit lake with very poor quality water. We offer the following comments:

9-1 I. **Pit Water Chemistry:** The modeling effort for this pit appears to be sophisticated and involved a large amount of numerical calculations. However, it is becoming increasingly apparent that the BLM is now using the modeling results inappropriately. Since these models have never been verified for an actual pit lake, they are useful only in a very general sense. Predicting how the lakes chemistry will evolve over 300 years is particularly problematic, and gives the false impression that the results are predictive of what will actually happen. The BLM should discuss the use of models with staff of the USGS, who have been very active in their development. Kirk Nordstrom of the USGS in Denver is particularly knowledgeable and his comments would be

9-2 useful. Additionally, the rock data used to develop the model is not extensive, and less than what has been available in other pit lake studies.

9-3 With these limitations in mind, I am also concerned that the pit lake model is assumed to be "environmentally conservative (i.e. worst case)". Although the procedure used for this model includes assumptions which are conservative, other assumptions within the model may be incorrect and entirely invalidate the model. The evolution of pit lakes is not well understood, and models for predicting pit lake chemistry are useful as research tools for better understanding how

LAS VEGAS GROUP
P.O. Box 19777
Las Vegas, Nevada 89119

To explore, enjoy, and protect the wild places of the earth . . .

GREAT BASIN GROUP
P.O. Box 8096
University Station
Reno, Nevada 89507

Response to Letter 9

09-01 The hydrologic and geochemical models used to support the EIS used the best available technology and currently available data. The period of 330 years was selected because ground water modeling indicated that the water level in the pit lake would be fully recovered by that time. Due to uncertainties of future climatic conditions, ground water flow rates, and ground water chemistry, the confidence in the predictions of pit lake water quality decreases with increasing time after the end of mining. Therefore, predictions made several decades or centuries in the future should be viewed as indicators of relative trends in concentration, rather than absolute values. However, the trends (in ground water recovery, pit-lake chemistry, and ecological risk) are reasonable and should be considered. The text for PTI's pit-lake water quality report[4] and the ecological risk assessment[7] have been modified to include discussions of uncertainty, as has the text of the Final EIS **(pages 3-54 and 3-85).**

09-02 The database used to characterize the rock at the Round Mountain mine is extensive. The geologic characterization of the deposit is based on useable data obtained from 2,700 drill holes and 480,000 blast holes. The sulfide sulfur content of the rocks in the deposit were determined from 60,000 Leco furnace analyses, and the data are included in the geologic block model for the mine. Figure 4-1 (PTI[4]) shows the distribution of sulfide sulfur below the predicted final elevation of the water table. In addition, Meteoric Water Mobility Procedure tests have been performed on materials from the mine as required by the Nevada Division of Environmental Protection. The net neutralizing potential and acid-extractable metals (for 31 analytes) were determined for 116 samples of wall rock, which were carefully selected to be spatially dispersed across the ultimate pit surface (see Chapter 4, PTI[4]).

In addition, following the publication of the Draft EIS, 20 humidity cell tests were completed to kinetically test the potential for rock materials at the mine to release metals and acid. These tests were performed for 20 weeks for net-neutralizing materials and 30 weeks for potential acid-generating materials. Leachates from these tests were analyzed for the Nevada Profile II analyte list and were used in the revised pit lake water quality predictions (PTI[4]).

09-03 The pit lake model is not meant to be a worst-case analysis (someone can always think of a worse case). The EIS states that some of the assumptions made in developing the input for the pit lake water quality model are considered "environmentally conservative (i.e., assumptions that will result in predicted poorer water quality in the pit lake)."

Letter 9 Continued

9-3 pit lakes will evolve. But until they are well understood, modelling with unsubstantiated assumptions is inappropriate, particularly when those modeling results are used for regulation 300 years in the future. This model, and other models, have not been based on any real pit lake data. Thus, the model results, with all of the detail, are only as good as the initial framework of the processes that control the chemistry in the pit lake water. Other sets of initial assumptions are equally as valid, particularly when they are based on real pit lake data.

9-4 An alternative initial vision of the pit lake is that the dewatering during mine development exposes a large, but unknown surface area in the surrounding geological formation to oxygen. This material had previously been flooded and oxygen transfer rates were sufficiently slow that the rock exists primarily in a reduced state. When the water table is lowered, oxidation processes occur and generate a large amount of oxidized rock surfaces. This total surface can potentially be many times greater than the exposed pit surface area. When the pit refills, those materials are flushed into the pit and produce a water that is potentially acidic, but probably is highly enriched in a variety of contaminants.

9-5 This scenario very probably happened in the Getchell Mine pit lakes. Although the geology of that system is different than the Round Mountain Mine, the results indicate the great degree of complexity that can occur in a pit lake. In 1968, after approximately one year of closure, the pH of the Center and South pit water was acidic (pH 3-3.5), and contained 1400-1700 mg/L sulfate. In 1982, the pit lake chemistry had changed, and the pH was now 5-6.6 and the concentration of sulfate remained at 1400-1700 mg/L. The sulfate concentration had not changed substantially, even though these lakes were presumably filling. These actual data conflict with the prediction in the Round Mountain pit lake model that suggests that sulfate concentrations will rapidly decline between years 9 and 22.

9-6 Additionally, the assumption that the lake will be oxygenated completely is open to question. Although the Yerington pit lake is generally well-oxygenated and well-mixed, the lakes at the Getchell Mine varied. In 1983, the sulfate concentrations in the South pit varied from 858 mg/L at 5 feet depth to 1,350 mg/L at 70 feet depth. Arsenic concentrations at the same respective depths varied from 0.14 mg/L to 3.0 mg/L, and suggest that this pit was not oxygenated since the higher arsenic concentrations may well have been the result of a lower redox potential and dissolution of iron species. In the Center Pit, sulfate concentrations varied in the opposite direction, with 1,290 mg/L at 5 feet depth and 1,050 mg/L at 80 feet depth. Arsenic concentrations increased with depth from 0.057 mg/L at 5 feet to 0.28 mg/L at 80 feet. Thus, in both cases, arsenic increased with depth and may reflect a low concentration of oxygen at depth. Neither pit lake was well mixed.

9-7 Under any circumstances, the assumption that arsenic will be effectively eliminated by precipitation with iron does not appear to be valid. The additional assumption that the entire pit is oxygenated (p 3-53) is also not necessarily valid. If the lake becomes stratified (as the Getchell Mine lakes), the lake will almost certainly not be oxygenated. If not oxygenated, the assumption that "precipitated or adsorbed chemicals are removed completely" (p-3-53) is also not valid. If fact, the entire model would be invalid, since it would be based on a scenario that is incorrect.

9-8 Data from five sampling times at the Boss Gold Mine in Esmeralda County also show an increasing sulfate concentration between 1990 and 1995, from 3270 mg/L to 4,540 mg/L. This is also hardly supportive of the assumption that sulfate concentrations will decrease as the pit fills. Arsenic concentrations also appear to be increasing, from an initial 0.91 mg/L to 1.2 mg/L over

Response to Letter 9

With respect to the comment that pit lakes are not well understood and not based on any real pit lake data, the processes used to model the pit lake water quality are based on processes known to occur in pit lakes and at mine sites throughout the world. Upon cessation of dewatering activities, the pit will fill with water derived from ground water and surface water runoff from the sides of the pit (the pit lake will have no other surface inflows). Thus, the pit lake model includes real data used to characterize the water quality of the pit inflow, including ground water analyses from wells at the mine and Meteoric Water Mobility Procedure tests performed on rock materials from the mine to characterize the water quality of surface runoff.

In addition, sulfide minerals (i.e., pyrite) in the walls of the open pit will oxidize when exposed to atmospheric oxygen as the elevation of the water table is depressed during mining. The oxidation of sulfide materials when exposed to atmospheric oxygen is well documented in the literature. The potential for the wall rock to oxidize and release metals into the environment is based on a model for pyrite oxidation (which uses measured pyrite oxidation rates at several mine sites in Nevada) and the predicted metals releases from 20 humidity cell tests performed on materials from the mine.

The limnological modeling is based on site-specific meteorological data and information obtained from other lakes (both natural and pit lakes) in the state of Nevada.

09-04 The scenario described is not an "alternative initial vision of the pit lake" but is in fact, identical to the conceptual model used to evaluate oxidation of wall rock for the Round Mountain pit lake and the potential for this wall rock to generate acid and release metals into the lake upon inundation with ground water following mining. Please see Chapter 4 of PTI's water quality report[4] entitled "Determination of Chemical Releases from Oxidized Wall Rock," which provides an extensive discussion of the methods used to evaluate oxidation for the Round Mountain pit lake.

09-05 Although it is true that oxidation of wall rock probably occurred at the Getchell Mine pit lake, the actual concentrations observed at that mine are irrelevant to the study at the Round Mountain site. As noted by the Sierra Club, the "geology of [the Getchell] system is different than the Round Mountain Mine." In particular, rocks and ground water of the Getchell trend contain substantially elevated levels of arsenic (Grimes et al. [16]). The geochemical evolution of each pit lake is dependent on the geologic conditions at the mine, the quality of the ground water flowing into the mine upon cessation of dewatering, the hydrologic balance (e.g., evaporative loss, rate of ground water inflow) for the pit lake, and several other processes. Thus, although studies of other pit lakes can provide insight into their behavior, particularly with respect to lake stratification and turnover, the chemistry observed in one lake is not directly applicable to the chemistry of another lake in a different geologic and hydrologic regime.

Response to Letter 9

With regard to predicted sulfate concentrations, the pit lake water quality model has been revised to include new data from humidity cell testing that became available after the preparation of the Draft EIS. The revised predictions indicate that sulfate concentrations will increase steadily over time, although predicted concentrations are similar to the original predictions. Sulfate decreased between 9 and 22 years in the original model because of the predicted precipitation of gypsum ($CaSO_4$). In addition, as was noted above, sulfate concentrations in the Getchell Mine pit lakes, or any other lakes, are not directly relevant to predicting sulfate concentrations in the Round Mountain pit lake. Sulfate concentrations in the Round Mountain pit lake will be strongly dependent on site-specific conditions at the Round Mountain mine.

[16] Grimes, D.J., W.H. Ficklin, A.L. Meier, and J.B. McHugh. (1995). Anomalous gold, antimony, arsenic, and tungsten in ground water and alluvium around disseminated gold deposits along the Getchell Trent, Humboldt County, Nevada. *J. Geochem. Explor.* 52:351-371.

09-06

Please see the response to comment 02-02. As the Sierra Club's example demonstrates, some pit lakes are well oxygenated and others exhibit some stratification. Many lakes are stratified for a portion of the year, but mix during a period of turnover in the spring and fall. The observation that the Getchell Mine exhibited some stratification during a sampling round in 1983 is not relevant to the Round Mountain pit lake because (1) oxygenation of a pit lake depends on the biological, geochemical, hydrologic, and climatologic conditions at the mine and must be evaluated on a site-specific basis, and (2) observed stratification during one sampling round does not mean that the lake does not mix completely at other times of the year.

09-07

It is well demonstrated that (1) under oxygenated conditions iron oxides precipitate at pit lakes, and (2) arsenic sorbs strongly to iron oxide and is removed to some extent with the precipitating iron oxides (Dzombak and Morel[17]). The presence of arsenic in the pit lakes at the Getchell Mine is not relevant to predictions made for Round Mountain because the concentration of arsenic in the Getchell Mine is dependent on site-specific factors at that mine, including the amount of iron entering the lake, the presence of oxygen in the lake, and the amount of arsenic entering the lake. The Getchell Mine is also located in an arsenic anomaly (Grimes et al.[16]), where elevated arsenic concentrations have been observed in ground water.

With regard to the assumption that the pit lake will remain oxygenated, please see the response to comments 02-02 and 09-06.

[17] Dzombak, D.A., and F.M. Morel. (1990). *Surface Complexation Modeling: Hydrous Ferric Oxide*. John Wiley and Sons. New York.

Letter 9 Continued

9-8 the 5-year period. This may be partially reflected in the pH increase from 8.00 to 8.24. Arsenic sorption onto oxide surfaces (i.e. iron oxide) decreases with increasing pH. Selenium concentrations also increase, from 0.009 mg/L to 0.064 mg/L.

9-9 The selenium issue is particularly noteworthy, since it increases by a factor of 7 during the five years. No selenium was detected in the limited sample set for the Round Mountain pit water modeling. However, selenium concentrations in a 1:1 extract of spent ore on the reusable pads show a mean selenium value of 0.063 mg/L. Since this rock presumably came from the pit, a source of selenium is present, and suggests again that the modeling exercise is of questionable validity.

9-10 Although imperfect, the data above are from actual pit lakes and indicate the complexity of pit lake chemistry. They also suggest that the assumptions in the Round Mountain model may, with equal probability, not be valid. As presented, the modeling results are no more than a reasonable conjecture of contaminant concentrations, based on one set of assumptions. Other sets of assumptions (stratification of the lake, oxidation of geologic material during dewatering) are equally valid and have been demonstrated at other sites in Nevada. Those other sets of assumptions can provide a water quality that is substantially different and potentially more toxic than that proposed in the Round Mountain model.

9-11 What the modeling results do show, however, with a reasonably high level of confidence, is that arsenic will be a problem, sulfate will be a problem, fluoride will be a problem, and antimony will be a problem. The 1:1 extractions in Table 3-10 also suggest that nickel may be a problem, selenium is very likely to be a problem, and the very toxic thallium may also be a problem. Thallium, in particular, was found at very high concentrations in the South Leach offload material and suggests that it may be present in parts of the pit.

Use of these modeling data for a wildlife risk assessment is also highly problematic, since the risk assessment is based on calculated values that are questionable, and not necessarily conservative. However, the statement on page 3-88 is reasonable, and compelling:

> "Based on the results of the ecological risk assessment, the Round Mountain pit lake may cause long-term impacts to individual waterfowl, as well as population-level impacts"

Additionally, from NAC 445.24352

"3. Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which:

> (a) has the potential to degrade the ground waters of state; or
>
> (b) has the potential to affect adversely the health of human, terrestrial or avian life."

Response to Letter 9

09-08 As stated above, observations of concentrations at other pit lakes, including the Boss Gold Mine, are not relevant to the conditions at the Round Mountain pit lake.

09-09 Selenium concentrations in the spent ore are not necessarily related to concentrations that will be observed in the pit lake. Pit wall rock, in general, is not considered ore because it is typically less mineralized and is too low a grade to be mined; therefore, pit wall rock will typically contain lower concentrations of elements of concern. Selenium concentrations in the Round Mountain pit lake will depend on the selenium present in ground waters at the Round Mountain mine, the amount of selenium released from oxidized pit wall rock, and geochemical reactions within the pit lake, all of which are considered in the pit lake water quality modeling.

09-10 The "other sets of assumptions" proposed by the Sierra Club are identical to assumptions already included in the pit lake water quality model and described extensively in PTI's technical report, Predicted Water Quality in the Round Mountain Gold Company Pit Lake[4]. As discussed above, oxidation of geological material during dewatering is considered in the modeling (see Chapter 4[4]). In addition, limnological modeling of the Round Mountain pit lake (Chapter 5[4]), indicated that it would, in fact, be stratified for a portion of the year. However, the lake is predicted to turn over in the fall, allowing complete mixing and oxygenation of the lake.

09-11 The Sierra Club's statement that several constituents will be a problem is subjective. It is not clear what scenario will cause the concentrations in this lake to be problematic. Human access to the pit lake will be precluded as described in the proposed action. The lake does not have the potential to degrade surrounding ground water because it will have no ground water outflow. Therefore, constituents in the lake will not pose a threat to humans or to ground water quality. In addition, the potential for constituents in the lake to be a problem for wildlife was evaluated in the ecological risk assessment[7].

With respect to the values predicted in Table 3-10 and thallium in particular, ground water samples from two dewatering wells (one screened in the Tertiary volcanics and the other in the Paleozoic metasediments) were analyzed for thallium on December 7, 1995. Thallium was not detected in either sample (detection limit = 0.005 milligrams per liter). The table has been corrected to show that the concentrations were below the detection limit, and therefore, a representative mean concentration could not be calculated.

Letter 9 Continued

Thus, it would seem that the analysis in the EIS provides a rather clear indication that the potential exists to adversely affect avian life by creation of the pit lake. It does not show that such an impact *will* occur; it states that such an impact *may* occur, which is the standard implied in the NAC which only requires that the *potential* exists to adversely affect wildlife.

9-12 Thus, a reasonable person would argue that the BLM cannot allow the pit lake to be created, since to do so would violate the Nevada Administrative Code. Other options should be considered, including refilling the pit or establishment of a fund for permanent dewatering. Or, the BLM can establish a fund or a bond for long-term remediation of the pit water.

9-13 Additionally, the assumption that water will not migrate from the pit lake is questionable. A set of circumstances could be created which indicate that the separate aquifers exist within the pit depth, with differing rates of water movement. If water entering the pit came primarily from the top aquifer, the lower aquifer may not be substantially affected by the water flowing into the pit and result in regional groundwater movement similar to what existed prior to creation of the pit. Thus water flowing into the pit would move out of the pit and contaminate groundwater, also in violation to the NAC above. Even simple diffusion processes over a 300 year period are likely to allow movement of contaminants into the surrounding groundwater system. It is clear that a uniform flow of water into the pit from all directions which are submerged will probably result in no movement outward, and a scenario can be created which is consistent with the statements on page 3-58. As above, however, these modeling results are not based on a pit lake data set, and only on modeling from a series of assumptions. Data are available from the Boss Mine and the Robinson Project which show very high levels of contaminants near pit lakes. If these contaminants did not come from the pits, where did they originate? One may argue that they existed prior to mining, but until the data are properly analyzed from the real systems, the conjecture that the water will not move is unsupported, and potentially incorrect, given the data that exists for actual pit lakes.

9-14 The monitoring well locations are generally located some distance from the pit. It would seem reasonable to have ground water monitoring wells within 500 feet of the pit, in order to have a better warning system on potential contamination. Having 2-4 wells downgradient would provide a better demonstration that groundwater was not being impacted. As they are presently located, it may take many years before any pit lake contamination would be observed. Why are there no data in Table 3-9 from monitoring well MW-10, which is the only well very near the pit?

9-15 The lake is predicted to lose approximately 400 gal/min through evaporation. This translates to between 600 and 700 acre feet per year of water loss. Does the mine proponent have a water right for this much water? Will one be required?

9-16 **2. Meteoric Water Mobility Data** Use of the meteoric water mobility procedure for assessment of drainage water quality from waste rock dumps and leached heap material has never been established as a method which can predict drainage water quality, or the amount of contaminants which can ultimately drain from a heap. This method only provides an indication of the contaminants that are extracted from the solid sample using a 1:1 extraction. It thus predicts the concentration of contaminants which will elute from a pile of solid material which is less than two meters high. Obviously, this is not the case for precious metals heaps. It also does not consider sorption of contaminants and thus will not provide an indication of the total quantity contaminants which will ultimately be released from the mine waste. The data are only of limited value and are not sufficient to allow a determination of whether soils which receive the drainage

Response to Letter 9

09-12 Please see the responses to comments 01-01 and 17-14.

09-13 Potential for Ground Water Outflow: Extensive subsurface information, water level measurement data, and numerical flow model results support the interpreted hydrogeologic conditions in the vicinity of the open pit. For example, the data set used to calibrate the flow model included water levels collected at 123 wells; 81 of these wells were used to calibrate the change in water levels in response to mining and dewatering. None of these data support the speculation of possible outflow from the pit lake to a deeper aquifer as put forth in the comment. To the contrary, water level data from exploration holes, dewatering wells, and monitoring wells in the bedrock units to be exposed at closure indicate that the deeper bedrock units are partially confined, and therefore, there is some upward component of flow in the deeper bedrock units (not downward as suggested in the comment). In addition, the flow of hot water associated with the geothermal system also has a strong upward component. The subsurface information, water level measurements, and numerical modeling support the prediction that the final elevation of the pit lake will be lower than the elevations of the regional potentiometric surfaces associated with all adjacent bedrock aquifers for the foreseeable future. As a result, the flow gradients for the fractured bedrock units in the near vicinity of the pit are predicted to be toward the pit. Therefore, the pit should receive ground water inflow (from all directions) from units adjacent to the final pit. Under these hydrologic conditions, ground water outflow is not anticipated.

Potential for Movement of Contaminants by Diffusion: Because of evapoconcentration, the pit lake water is predicted to have higher concentrations of certain constituents than the adjacent ground water aquifers. Since the lake will behave as a hydrologic sink, diffusion would act against the direction of ground water flow but would only be significant if the rate of diffusion were greater than the ground water inflow velocity. The following calculations were performed to evaluate whether diffusion would be a significant factor in transporting pit lake constituents into the ground water aquifers. Where the input parameters for these calculations are best represented by a range of values, care was taken to select the input values that would result in the lowest ground water flow velocity and the highest rate of diffusion.

1. Ground Water Flow Velocity
   A minimum ground water flow velocity can be calculated from the water levels observed after 95 percent recovery in the pit lake (Figure 26, Hydro-Search, Inc.[3]). The lowest ground water gradients exist along the southwest edge of the pit lake; in this area the ground water gradient is approximately 0.05. The mean hydraulic conductivity of the bedrock units in the vicinity of the pit range from 0.1 to 3.0 feet per day. The specific yield of these bedrock units, which is approximately equivalent to the effective porosity, varies between 0.05 and 0.0005. Assuming the lowest hydraulic conductivity and the highest specific yield (to calculate the lowest ground water velocity), the calculated ground water velocity along the southwest edge of the pit would be approximately 1.8 feet per year.

Response to Letter 9

2. Diffusion Rate

Using a derivation of Fick's second law of diffusion, the amount of time, t, it would take for diffusion alone to transport a contaminant a certain distance, x, is given by:

$$C_i = C_o \ \text{erfc}\ (x / (2 \ \text{sqrt}\ (D^* \ t)))$$

where C_i and C_o are the concentrations of the native ground water and the pit lake respectively, erfc(x) is the complementary error function, and D^* is the diffusion coefficient (Freeze and Cherry[18]). The diffusion coefficient for inorganic constituents ranges between 1×10^{-9} and 2×10^{-9} feet squared per second.

Diffusion rates for sulfate, chloride, and aluminum were calculated. Sulfate and chloride were selected since the concentrations of these ions should not be affected by chemical reactions in this hydrogeologic setting; aluminum was selected as a representative metal. As input to these calculations, the lowest background ground water concentrations measured were used to calculate the maximum diffusion rate. The modeled pit lake concentrations (PTI[4]) for sulfate (860 milligrams per liter), chloride (199 milligrams per liter), and aluminum (0.49 milligrams per liter) are over an order of magnitude higher than the lowest background ground water concentrations for sulfate (59 milligrams per liter), chloride (12 milligrams per liter), and aluminum (0.01 milligrams per liter). The lowest value for aluminum used in this calculation, 0.01 milligrams per liter, was assumed because it is one half the laboratory detection limit. Based on these concentration gradients only, the calculated diffusion rates are 0.0022 feet per year, 0.0024 feet per year, and 0.0018 feet per year, respectively for sulfate, chloride, and aluminum. These rates of diffusion are very slow and indicate that diffusion is not a significant factor in the transport of pit lake constituents out of the lake. Furthermore, since the rate of ground water flow (1.8 feet per year) into the pit is approximately 1,000 times greater than the rate of diffusion out of the pit, diffusion is not expected to impact the quality of the regional ground water system or waters of the state.

Again, with regard to metal concentrations at the Boss Mine and Robinson Project, concentrations of constituents in ground water at other mine sites are not relevant to the SVCO pit lake, which is predicted to have no ground water outflow at any time in the future (HSI 1994[17]). Ground water concentrations will depend on the geologic and hydrologic conditions and historical activities at the mine.

---

[18] Freeze and Cherry. (1979). *Groundwater*. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

Response to Letter 9

09-14 As discussed in the response to comment 09-13, the pit lake is not anticipated to impact the water quality of the surrounding ground water system. Since no impacts to ground water are anticipated, no monitoring or mitigation measures are proposed. Also note that Well MW-10 has been removed from Figure 3-10 since no water quality data exist for this well. Apparently, MW-10 has only been used to obtain periodic water level measurements due to well bore/sampling limitations.

09-15 Please see the response to comment 07-01.

09-16 The Meteoric Water Mobility Procedure (as required by the Nevada Division of Environmental Protection) measures leachate in a 1:1 ratio of water to rock and is used by the SVCO to estimate solute concentrations in runoff from waste rock. The BLM recognizes that this is an approximation, and that no test will perfectly simulate runoff concentrations. The alternative test proposed by the Sierra Club, EPA Method 1312 (Dr. Miller references this method on page 3, line 14 of the transcript from the October 18, 1995, public meeting in Reno), uses a 20:1 water to rock ratio, and thus typically predicts lower solute concentrations than the Meteoric Water Mobility Procedure tests. This was shown in a comparison test between the Meteoric Water Mobility Procedure and EPA Method 1312 on 18 rock samples conducted by McClelland Laboratories in Sparks, Nevada. The comparison test indicated that trace metals of environmental concern typically have higher concentrations in the Meteoric Water Mobility Procedure than in EPA Method 1312. As a result, the Meteoric Water Mobility Procedure method is considered to be more environmentally conservative (i.e., it tends to predict higher leachate concentrations than will actually occur). The comparison test also demonstrates that, for constituents such as arsenic that tend to adsorb strongly to surfaces, the Meteoric Water Mobility Procedure and Method 1312 tests produced similar results (e.g., Meteoric Water Mobility Procedure leachates had average arsenic concentrations 1.7 times higher than the Method 1312 samples). For these constituents, aqueous concentrations typically are limited by solubility and will be relatively independent of the height of the waste-rock pile, runoff length, or other facts that affect the water to rock ratio.

Neither the Meteoric Water Mobility Procedure nor EPA Method 1312 will determine the total amount of contaminants that will ultimately drain from the heap. The total mass leaving the heap will depend on the volume of water infiltrating through the heap and the contaminant concentrations in the infiltrating water. However, the Meteoric Water Mobility Procedure probably provides a good estimate of the concentration of constituents in the infiltrating water, and is thus an important component of the overall assessment of the potential impact to the environment. Finally, it should be noted that substantial attenuation of constituents is likely to occur between the heap and the subjacent ground water. Such attenuation is not considered in the Meteoric Water Mobility Procedure tests; but as stated in the EIS, attenuation will mitigate potential impacts to ground water.

Letter 9 Continued

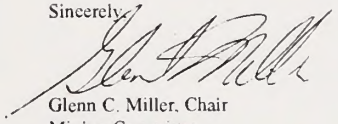
water will be affected, or whether surface water will be impacted. I have included a copy- of a letter sent to Doug Zimmerman on this issue which more completely addresses this issue.

9-16 Just because it is being used in Nevada is not sufficient reason for the BLM to make management decisions using this procedure. A proper test is one which allows a determination of the concentration of contaminants in the fluids which drain from the bottom of a heap, and a determination of the total amount of contaminants which will ultimately drain from the heap. Various EPA methods are available for these determinations, but as presented in the EIS, the data are not sufficient to make a determination that the heaps do not present a long-term problem. For example, the data from the South Leach Offload Pile indicate that thallium is a problem. This very toxic metal exists in a 1:1 extract nearly 1000 times greater than the drinking water standard. How will this material be managed, and how much of it will migrate from this waste pile? What are the concentrations that would be allowed by the BLM?

9-17 How will the soil contamination levels be monitored? Will there be quarterly or yearly sampling required to determine the level of contamination around the waste piles? It is very likely that several hundred tons of arsenic, selenium, thallium and fluoride will be released from this spent mine waste. The BLM should determine how a monitoring program will be established and standards for protection of soils and water over the long term.

Again, thanks for the opportunity to provide these comments. These are very new issues, and I appreciate the efforts of the BLM, the consultants and the mining company to better understand them. I believe that careful thought and appropriate regulation will both protect the environment and the mining industry from long-term liability.

Sincerely,



Glenn C. Miller, Chair
Mining Committee

Response to Letter 9

The Nevada Division of Environmental Protection has authority for and primacy over protection of waters of the State. The Division endorses the Meteoric Water Mobility Procedure as a valid test used to enforce State law designed to protect waters of the State. The BLM does not question the test that the Nevada Division of Environmental Protection uses to enforce State laws.

With respect to thallium, thallium was never detected in Meteoric Water Mobility Procedure tests of the spent ore or leach offload piles. Table 3-10 has been corrected accordingly.

09-17 The potential impacts associated with soil contamination due to runoff from the leach offload piles have been added to Section 3.2.2.1 (**pages 3-45 and 3-47**) of the Final EIS. In addition, mitigation measure WR-3 has been added to Section 3.2.4 (**page 3-63**) of the Final EIS as a measure to minimize potential exposure to wildlife and livestock during operation and post closure. The mitigation includes placement of siltation berms to restrict runoff migration and periodic grading (or fencing) between the offload piles and the berm to eliminate vegetation. At closure, a sufficient depth of growth media would be placed in areas that collected runoff during operation to limit the potential for plant uptake during the postclosure period. These measures should restrict plant uptake and wildlife exposure; therefore, quarterly or yearly sampling and monitoring are not considered necessary.

UNIVERSITY OF NEVADA RENO

COLLEGE OF AGRICULTURE

Environmental and Resource Sciences / 199
Fleischmann Agriculture, Room 128
Reno, Nevada 89557-0013
(702) 784-6400
FAX (702) 784-1142

October 25, 1995

Doug Zimmerman
Division of Environmental Protection
Bureau of Mining
333 West Nye Lane
Carson City, NV 89710

Dear Doug:

As we discussed, I have been a long-time critic of the Meteoric Water Mobility Test, and am concerned that the Division is considering continuing this test as a method of characterizing spent heap material. Although also not perfect, EPA method 1312 (Synthetic Precipitation Leaching Procedure) has significant advantages over the MWMT and will provide a better indication of the total quantity of contaminants which can be mobilized from heaps being closed.

The overall goal of these type of tests should be to predict both the drainage water quality from heaps and also the total quantity of contaminants which can be mobilized from the heaps. Thus, during heap closure, an assessment of the water quality which drains from the heaps over the long term should consider the expected flow (hydrologic study), the time-varying water quality, and the ultimate total quantity of contaminants (including total dissolved substances) which will be discharged from the heap. Spent ore is a highly mineralized material which has been crushed, chemically treated and allowed to oxidize in an aqueous environment during the heap cycle. As you are well aware, this mineralized ore releases a large variety of materials in addition to gold and silver. Those are the substances of concern and should be the focus of regulatory actions.

Each constituent in a heap will have different characteristics which determine the degree of mobilization. Soluble salts (i.e. chloride) are sorbed poorly and will rinse rapidly from a heap. Alternatively, strongly sorbed materials (i.e. divalent mercury) are strongly held and may never be a drainage problem, unless the pH decreases substantially. The intermediate sorbing contaminants (i.e arsenic, chromium and selenium species, and mercury cyanide) are the major concern and these contaminants are not adequately addressed by the MWMT.

Sorption is not addressed by the MWMT, and I feel, provides a misleading description of the water quality which will drain from a heap. The MWMT merely indicates what quality of water will be delivered from mine waste which is piled the same height as the column used in the MWMT, which is not specified in the draft method, but is presumed to be less than two meters. As you will agree, there are effectively no examples of heaps which are two meters high. Instead, heaps can range over 50 meters high. Thus, the numbers from the MWMT will have only very limited usefulness for predicting the water quality which will drain from larger heaps. In a heap (or waste rock dump), water will pass through the entire column of the heap and interact with a very large amount of rock in a closed circuit. The water finally draining from the bottom will represent the equilibrium distribution of each of the contaminants in association with the spent

Letter 9 Continued

heap material. Neither the MWMT or method 1312 will accurately predict the concentration of contaminants in the water draining from the spent heap. The best (and least expensive) way to assess that water quality which drains immediately on closure is to simply take samples which have drained from the heap. If that water quality meets drinking water (or other more stringent) standards, including TDS, the heap probably does not present a significant risk to surface or groundwater quality or soil fertility, since it is probable that this drainage represents the poorest quality of water which will drain from the heap. However, if the heap contains toxic contaminants or high salinity, further efforts to characterize the heap are warranted. The MWMT does not provide much additional useful information, compared to the simple and inexpensive method of monitoring the heap drainage.

The MWMT will also not predict the total quantity of contaminants which can be mobilized from the heaps over the long term. This number can be approximated by use of a test which reduces the effects of sorption and uses a large ratio of water to heap material. Method 1312 uses a twenty-fold ratio of water to solid. Although sorption is still a factor, it becomes much less important than the 1:1 extraction of the MWMT. The data obtained from method 1312 should then be multiplied by the dilution factor (20x) to obtain an estimate of the mobilizable contaminants from the heap material. From the Borealis data which you provided, the MWMT underestimated the amount of mobilizable contaminants by a factor of 6 to over 10, compared to method 1312. If the Borealis heap is 10 million tons, for example, the total amount of mobilizable arsenic is 240 tons; the selenium load is 6.6 tons.

Table 1. Metal Mobility Test Comparison Data Borealis Depth Composite FF 0-20'

Element mg/L	NDEP MWMT	EPA 1311 (TCLP)	EPA 1312	Estimate of Heap Mobile Contaminants 1312 x 20
Arsenic	1.8 mg/L	0.29 mg/L	1.2 mg/L	24 mg/kg
Barium	<0.25	1.1	0.59	11.8
Mercury	0.003	0.002	0.002	0.04
Selenium	0.11	N/D	0.033	0.66

For these data, the majority of arsenic on the heap material is sorbed and will provide a continuing source of this contaminant in the underdrain flow for a long, but undetermined time period. Selenium is also substantially sorbed, although less so than arsenic. More sophisticated column techniques and sorption studies can also be devised, although these will require a substantial research effort. Ultimately these could provide a more complete assessment of the time-varying concentration of contaminants in the water which drain from a heap. The rate of release of contaminants from the heap is also critically dependent on the hydrologic characteristics of the heap.

Each mine waste will be different and different contaminants will become regulatory issues at different sites. However, the meteoric water mobility test does not provide a useful indication of either the effluent concentrations from a heap or the total quantity of materials which will

eventually be mobilized from a heap. Despite the fact that it has been used extensively in Nevada for many years, I am unaware of thorough studies which indicate that the MWMT is an effective predictive test. It does have some obvious merit in that it will indicate which contaminants will be released, but I feel strongly that other tests can be performed less expensively which will provide a more complete assessment of the potential contaminants which drain from a heap.

The above analysis assumes that the chemistry of the heap will be unchanged, which may be an incorrect assumption. Data I have seen from the Wind Mountain Heap, for example, indicates that mercury decreases over time. The reason for those decreases is not known, but probably involves chemical alteration of mercury cyanide. Selenium also decreases in heap effluent, for reasons that are also not well known. While transformation of mercury cyanide to mercuric ion will result in sorption of the mercury, the fate of selenium is not clear, but may be tied up biologically and potentially released when those microorganisms die off. Arsenic sorption onto iron oxides is strongly influenced by pH, and the sorption increases with decreasing pH (down to approximately pH 5). Thus, arsenic concentrations in the heap effluent will decrease as the pH is lowered over time. Alternatively, in heaps containing appreciable concentrations of sulfide, the pH may continue to drop and mobilize other heavy metals, particularly mercury. This issue is important as the low-grade sulfide heaps are brought into production following biological oxidation.

Because the MWMT gives higher concentrations of contaminants in the aqueous phase, detection limits for the 1312 method will need to be assessed and the appropriate analytical methods used to allow sensitive detection of the various substances, particularly mercury, arsenic and selenium. The cost of these more sensitive analyses is higher, but the overall cost of a 1312 method is still likely to be lower than the MWMP, particularly if lower amounts of material are used. Questions will arise as to whether less solid material will provide representative samples. However, a subsample from a well homogenized 5 kg sample should not significantly increase the uncertainty of the result, given the uncertainty of sampling from a portion of a large heap. Further work on representative sampling should, however, be undertaken no matter which procedure is used.

As we have discussed previously, I believe that a substantial amount of research is necessary to better understand the hydrology and chemistry of closed heaps. No other state has as much precious metals heaps as Nevada (1-3 billion tons), and Nevada should be providing the research leadership in closure of these operations. You might consider establishing a research committee for the Division which could make recommendations on research needs for decommissioning mines. These issues could then be discussed in an open scientific forum, which could provide better regulatory direction for mine closure and ultimately limit liability to the mining industry.

Sincerely,

Glenn C. Miller, Professor

cc Paul Shiedig

Letter 10

ROUND MOUNTAIN GOLD CORPORATION

SMOKY VALLEY COMMON OPERATION
P.O. BOX 480
ROUND MOUNTAIN, NEVADA 89045
(702) 377-2366

RECEIVED
BLM
95 DEC 21 P 1:52

November 20, 1995

Mr. Christopher J. Stubbs
Bureau of Land Management
Battle Mountain District Office
P.O. Box 1420
Battle Mountain, NV 89820

RE: Comments - Round Mountain Gold Corporation
Draft Mill EIS

Dear Chris:

After having experienced the development of the referenced document, we wish to submit comments on the following issues:

10-1 1. Efforts by consultants to extend modelling efforts beyond normal limits for determining ground water recharge characteristics, pit water quality calculations and wildlife risk assessment estimates should be seriously evaluated. A modelling period should be selected and agreed upon by the consultants and the BLM that is defensible within the limits of the Best Available Technology.

10-2 2. Concerns as to the validity of the Meteoric Water Molality Test (MWMT), as expressed in the Public Meeting of October 18, 1995, should be considered invalid. The test, as required by the Nevada Department of Environmental Protection (NDEP), appears to have several advantages over proposed EPA methods. Likewise,

Response to Letter 10

10-01 Please see the response to comment 09-01 regarding future predictions of ground water quality and ecological risk.

10-02 Please see the response to comment 09-16.

Letter 10 Continued

10-2 studies by the Nevada Mining Association (NMA) and consulting laboratories support the use of MWMT over proposed EPA methods.

10-3 3. Construction of the Mill and tailings facility, as proposed in the DRAFT, will have no effect on resultant pit water quality, hydrogeology or risks to wildlife. Table 2.8 illustrates this fact in comparison to other actions including the no action alternative.

10-4 4. Round Mountain Gold Corporation (RMGC) recommends that the BLM include the Nye County Commission in the final development/approval process of the Draft EIS to the extent required. We also wish to thank the BLM for their efforts in development of this document and in trying to meet project construction schedules.

Should you have any questions, please notify us at (702)377-2366.

Yours Very Truly,

Duane L. Whiting
Environmental Manager

Pete Kesl
Operations Manager

c: Chet Diercks
Steve Botts, EB/Reno

Response to Letter 10

10-03 The proposed mill and tailings impoundment would not affect pit lake water quality. As indicated in the response to comment 08-03, the pit water quality analysis was conducted to disclose the potential impacts to the public and to the agency decision makers because these impacts had not been disclosed in previous National Environmental Policy Act documentation.

10-04 The BLM has offered to meet with Nye County officials during the preparation of the Final EIS to discuss the National Environmental Policy Act process and the approach to addressing the issues raised in the Draft EIS; please see the response to comment 08-01.

Letter 11

NEVADA
Mining Association

5250 S. Virginia St.
Suite 220
Reno, NV 89502
(702) 829-2121
FAX (702) 829-2148
Las Vegas Phone
(702) 382-4904

PRESIDENT
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JAAK DAEMEN
STAN KINDER

November 15, 1995

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BUREAU OF LAND MANAGEMENT
BATTLE MOUNTAIN DISTRICT

Mr. Christopher Stubbs
EIS Project Manager
Bureau of Land Management
Battle Mountain District
P.O. Box 1420
Battle Mountain, Nevada 89820

Re: ***Draft*** **Environmental Impact Statement for the Round Mountain Mill and Tailings Facility**

Dear Mr. Stubbs:

The Nevada Mining Association (NMA) has reviewed and appreciates this opportunity to offer comments on the Draft Environmental Impact Statement (DEIS) for the Round Mountain Mill and Tailings Facility.

The NMA represents nearly five hundred (500) member mining companies, mining supplier businesses and individuals involved and interested in the mining industry in Nevada. The mining industry plays a very important role in the economic and social well being of the state. Because a large majority of Nevada's land base in under Federal management, the direction prescribed for those Federally controlled lands is of keen importance to NMA's members, especially when the potential and known mineral resources could be affected by such management direction, as is the case with the Round Mountain DEIS.

In general, NMA found the DEIS to be a well written and easily understood document. NMA believes the analysis of the proposed action applied the most up-to-date and appropriate science to allow the public a clear understanding of the short- and long-term environmental consequences. In light of those findings, NMA fully supports and strongly urges the Bureau to approve the proposed action as presented in the DEIS. 11-1

The only concern that NMA wishes to offer is one related to the lack of a clear qualifying statement regarding the potential water quality and quantity impacts illustrated in Table 2-8, Impact Summary and Alternatives Comparison. The DEIS did an excellent job of analyzing the pit water issues and impacts, yet it did not state that such issues and impacts clearly are independent of the proposed action to expand the mill and tailings facilities, except in Table 2-8 where the comparison to the no action 11-2

Response to Letter 11

11-01	Comment noted.

Letter 11 Continued

11-2 alternative and proposed action, under water quality and quantity, is identical. Thus, if the no action alternative has the same impacts as the proposed action, then the proposed action is environmentally benign. A clarifying statement to this fact should be made in the final EIS.

11-3 Furthermore, NMA is concerned about and questions the use of modeling studies that extend beyond the limits of available technology to predict ground water conditions, pit water quality, and ecological risk assessments. NMA suggests that, in the future, the Bureau should use a more reasonable time sequence than the 330 years to extract a prediction of future environmental conditions and risks.

11-4 In addition, NMA understands that there was a verbal comment offered at the public hearing regarding the validity of the Meteoric Water Mobility Procedure (MWMP) as compared to other available EPA testing methods. NMA is strong in its position that the MWMP is the most aggressive and representative testing method to estimate the mobility of metals and other environmental constituents from mined materials exposed to meteoric events. It is a superior test to the EPA 1312 method. If the BLM needs further information in support of the MWMP, please do not hesitate to contact NMA.

Again, NMA supports the proposed action to expand the mining operations at the Round Mountain Gold Corporation operation, and strongly urges the Bureau to approve the proposed action as presented in the DEIS. If you have any questions regarding NMA's comments or need further clarification, please do not hesitate to contact me at (702) 829-2121. Thank you very much for your careful consideration of these comments.

Respectfully submitted,
NEVADA MINING ASSOCIATION

Paul A. Scheidig
Director
Resource and Environmental Affairs

cc: Ann Morgan, State Director BLM

Response to Letter 11

11-02 Please see the response to comment 10-03.

As indicated on page 2-39 of the Draft EIS, the purpose of Table 2-8 is to summarize and compare the impacts associated with the proposed action and the project alternatives. The impacts associated with individual alternatives are identified only if they differ from the proposed action; therefore, the fact that an impact is the same as the proposed action does not necessarily equate to the lack of an impact (i.e., that the proposed action is "environmentally benign").

For consistency, the pit water quality impacts are identified for the proposed action and all project alternatives in Table 2-8. On pages x of the Summary and 3-88 of Wildlife and Fisheries, the Draft EIS clearly states that the pit water quality impacts to wildlife would be the same for the proposed action and the no action alternative.

11-03 Please see the response to comment 09-01.

11-04 Please see the response to comment 09-16.

Letter 12

923 W 16th Street
Safford, AZ 85546
October 12, 1995

RECEIVED
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1995 OCT 11 P 2:11
BUREAU OF LAND MANAGEMENT
BATTLE MOUNTAIN DISTRICT

Christopher Stubbs, EIS Project Manager
Battle Mountain District Office
Bureau of Land Management
P.O. Box 1420
Battle Mountain, NV 89820

Dear Mr. Stubbs:

I have examined the Round Mountain Draft EIS and offer the following comments:

12-1 1. Page 3-15. The first sentence incorrectly describes the location of the proposed mill and tailings facilities. RMGC is located in the southern portion of the Big Smoky Valley.

12-2 2. Page 3-50. In the first column last paragraph it is implied that the material in the tailings pond could potentially contain elevated concentrations of cyanide. In the first column, 3rd paragraph, page 3-79 the EIS states that "Residual cyanide in the mill tailings would be neutralized before the material is discharged into the proposed tailings impoundment, and mortality of migratory birds from cyanide would not be expected to occur." There appears to be a conflict in these statements.

12-3 Analyzing the concept of environmental "worst case" impact in light of "data gaps" does not support the "rule of reason" as outlined in the Council On Environmental Quality Regulations. Trying to develop mitigation for potential impact to mallards based on the present science of risk assessments is not "good science". The worst case analysis should only be utilized when the science used to back up the decision is well developed and accepted by the effected scientific community. Conclusions on page 45 of the Risk Assessment dated August

12-4 1995, done by PTI do not agree with the statement on page 3-88 of the EIS..."Based on the results of the ecological risk assessment, the Round Mountain pit lake may cause long-term impacts to individual waterfowl, as well as population-level impacts."

12-5 3. Page 3-61. First column second paragraph. A comma is used where it is not needed. After the phrase "moderately deep and deep" there is a comma which is confusing.

12-6 4. Page 3-65. Second column second paragraph. The last sentence discusses judicious handling and placement of plant growth media. How will this be done from a practical standpoint? How will the process be judged to be done properly? Will the successful completion of this task be determined at the time the reclamation bond is released? Will the unsuccessful completion of this task be judged reason to withhold the reclamation bond?

Response to Letter 12

12-01 From the standpoint of hydrographic basins, the Big Smoky Valley is subdivided into a northern area and southern area. A subtle drainage divide located south of the mine separates these areas. Therefore, the description as stated in the Draft EIS is correct.

12-02 The word cyanide was removed from the paragraph cited **(page 3-50)** in the Final EIS.

12-03 Conducting an ecological risk assessment does not constitute a worst-case analysis. The ecological risk assessment is used in this EIS as a tool to define predicted impacts to the wildlife resources in the vicinity of the Round Mountain mine. The BLM does not intend to use the results of this particular risk assessment to develop mitigation measures; please see the response to comment 01-01. Please also see the response to comment 12-12.

12-04 On the basis of the revised risk assessment, the conclusion is that population-level impacts are unlikely. The conclusions of both the risk assessment report and the Final EIS have been revised for consistency.

12-05 The comma has been removed.

12-06 The release of the reclamation bond is based upon reshaping, recontouring, growth medium application, and revegetation to meet specific stipulations, without regard to storage and handling of plant growth media. Decisions on how to store and handle plant growth media are left largely up to Round Mountain Gold Corporation. The BLM is primarily concerned with the successful completion of revegetation standards.

Letter 12 Continued

Revegetation test plots at Round Mountain indicate that alluvial material used as growth medium produces stands of vegetation equal to or better than native non-disturbed (BLM managed grazing allotments) areas.

12-7 3. Page 3-69. The reference to Figure 2-11 should refer to Figure 2-10. Figure 2-11 does not exist.

12-8 4 Page 3-87. First column second paragraph. The discussion of arsenic and selenium is understandable but why discuss mercury. The risk assessment evidently reveals that mercury is not a potential problem because the ingestion rate is only ½ of the lowest dose rate. The conclusion to be reached in this section is that mercury will not be a problem to wildlife in the ultimate pit lake.

12-9 5. Page 3-88. Under the cumulative discussion what is meant by "population-level impacts?" Is the implication that the entire mallard population will be affected by the pit lake or merely the population that will use the pit lake as a bed and breakfast? The pit lake will be on

12-10 private surface. Does the BLM or the U.S. Fish and Wildlife Service have the authority or desire to dictate what happens on private land?

12-11 6. Page 3-87. To what extent does Arsenic antagonize the effect of selenium toxicity? Is the effect quantifiable? Does arsenic cancel selenium? This is going beyond what is reasonable in the "worst case" scenario because the science cannot quantify the concern.

12-12 7. Page 3-83. First column, second paragraph. This paragraph states that "Additive, antagonistic, an synergistic effects were not evaluated because these effects are difficult to apply quantitatively with accuracy in ecological risk assessments." On the one hand the EIS states that the four chemical of concern were considered individually and on the other hand the decision maker is given the statement that "arsenic has an antagonistic effect on selenium toxicity". So what decision is to be concluded from this apparent oxymoron. The worst case scenario can only be used if supported by good science. The present risk assessment tool is not good science so therefore should not be used.

12-13 8. Page 3-147 through 3-155. The dumps should show the intention to slope the reclamation to 3:1 and revegetate. The present pictures depict an angle of repose final slope which unrealistic. The EA previously written for the expansion of the north dump system commits to 3:1 final slopes.

Sincerely,

Paul Dusenbury

Paul Dusenbury

Response to Letter 12

12-07 The figure reference has been revised.

12-08 Mercury was included in this discussion because this was the final step in evaluating exposure relative to toxicity reference values. The hazard quotient derived from the no-observed-adverse-effect level exceeded 1; therefore, a hazard quotient derived using the lowest-observed-adverse-effect level for mercury was evaluated (see the response to comment 03-05). This second hazard quotient was the subject of the discussion on page 3-87 of the Draft EIS. Because the risk assessment has been revised, this discussion does not appear in the Final EIS.

12-09 The "population" in "population-level impacts" refers to the population of mallards and their offspring that would be expected to use the pit lake. The definition of population has been clarified in the final risk assessment and in the Final EIS **(page 3-89)**.

12-10 Actions taken on private land can and often do have direct and indirect effects on surrounding public land. At the Round Mountain mine, potential wildlife impacts that occur on the portion of the pit that is private land are not confined to that small area. The wildlife species that may use the pit lake as a food or water source do not recognize administrative and private land boundaries.

12-11 The extent to which arsenic is antagonistic to the toxicity of selenium has not been quantified (Stanley et al.[19]). For this reason, the discussion on page 3-87 of the Draft EIS was qualitative and was made in the context of a qualitative uncertainty assessment (see response to comment 03-07). Arsenic is not known to cancel selenium, but dosing mallard ducks with the two metals simultaneously resulted in a mitigation of the reproductive effects of selenium. The mechanism for this antagonism was not described by Stanley et al.[19] This discussion has been deleted from the final risk assessment and the Final EIS.

---

[19] Stanley, T.R., J.W. Spann, G.J. Smith, and R. Roscoe. (1994). Main and interactive effects of arsenic and selenium on mallard reproduction and duckling growth and survival. *Arch. Environ. Contam. Toxicol.* 26:441-451.

12-12 While additive, antagonistic, and synergistic effects of chemicals were not considered *quantitatively* in the risk assessment, the antagonistic effect of arsenic on selenium was addressed *qualitatively* as part of a weight of evidence discussion of risk at the pit lake. Data describing interactions of chemicals within receptors are inadequate for quantitative analysis in the risk assessment. Please see the response to comment 03-07.

Response to Letter 12

The risk assessment does not represent an evaluation of a worst-case scenario. The assumptions are conservative through the screening process such that chemicals that pass screening can be dismissed from further consideration with confidence. For those chemicals evaluated using the food web model, realistic assumptions concerning drinking and feeding rates and the extent of pit lake habitat use were incorporated to calculate potential exposures. Site-specific information was used to select receptors of concern, and species-specific natural history information was used to develop exposure assumptions. The ecological risk assessment represented the most realistic scenario that could be derived with confidence.

Risk assessment is a method of organizing and evaluating interdisciplinary information in a systematic manner to provide a perspective on complex phenomena. It is not a process of experimentation or hypothesis testing, but does incorporate the results of peer-reviewed scientific studies. The risk assessment makes explicit those chemicals that will not impact wildlife and provides an evaluation of uncertainty with respect to remaining chemical impacts.

The risk assessment should be interpreted as an organized synthesis of information relevant to the problems addressed by the EIS. It allows the public and decision makers a view of the magnitude of potential chemical impacts from the project. The risk assessment is not intended to show scientific proof of any particular hypothesis.

12-13 The overall final slope of the waste rock disposal areas, as depicted in these figures, would be 3 horizontal:1 vertical. The figures are intended to represent this slope.

Letter 13

Public Comments

Round Mountain Mill and Tailings Facility
Draft Environmental Impact Statement

We invite and encourage you to comment on this Draft EIS and to participate throughout the EIS process. The Draft EIS public comment period closes on ***November 22, 1995.*** Comments must be submitted by this date. You may make comments on this form and leave them on the table in the back of the room, or send written comments to:

Bureau of Land Management
Battle Mountain District Office
Attn: Christopher J. Stubbs, Round Mountain EIS Project Manager
P.O. Box 1420
Battle Mountain, Nevada 89820

Name: LEO C. VATH

Address: PO BOX 1261
ROUND MTN, NV 89045

Affiliation (if any): ELECTRICAL LEADMAN FOR ROUND MTN. GOLD

Comment(s):

I AM VERY PLEASED WITH THE INDEPTH AREA'S THAT WAS COVERED BY THE EIS. HOWEVER I SOMETIMES QUESTION THE DELAYS IN THE EIS PROCESS THAT MIGHT CAUSE UNNECESSARY BURDENS AND COSTS. THAT COULD CAUSE LOSS OF JOBS AND PRODUTIVITY IN THE USA. I WONDER IF SOME ORGANIZATION SUCH AS SIERRA CLUB IS REALLY FOR THE USA. LETS WORK TOGETHER TO KEEP MINING BENIFICIAL FOR ALL.

Response to Letter 13

13-01 Comments noted.

Letter 14

Public Comments

Round Mountain Mill and Tailings Facility
Draft Environmental Impact Statement

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Bureau of Land Management
Battle Mountain District Office
Attn: Christopher J. Stubbs, Round Mountain EIS Project Manager
P.O. Box 1420
Battle Mountain, Nevada 89820

Name: ANN MCCRACKEN

Address: HC 60 Box 51197
Round Mtn. NV 89045

Affiliation (if any):

Comment(s):

As an employee of RMGC I am impressed with the policies and practices in place to protect the environment. As a mother raising a family this company has provided my children a community in which to grow up safe, away from gangs and violence. With the growth ~~[illegible]~~ associated with the addition of the mill, our town will improve economically and ~~[illegible]~~ socially.

Response to Letter 14

14-01 Comments noted.

Letter 15

Public Comments

Round Mountain Mill and Tailings Facility
Draft Environmental Impact Statement

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Bureau of Land Management
Battle Mountain District Office
Attn: Christopher J. Stubbs, Round Mountain EIS Project Manager
P.O. Box 1420
Battle Mountain, Nevada 89820

Name:	**Address:**	**Affiliation (if any):**
JONI EASTLEY	P.O. BOX 1369 RND MTN, NV 89045	TOWN OF ROUND MTN

Comment(s):

AS CHAIRMAN OF THE ROUND MOUNTAIN TOWN BOARD, I WHOLE-HEARTEDLY SUPPORT RMGC IN THEIR EFFORTS TO EXPAND AND INCREASE PRODUCTION AT THEIR FACILITY. THE ADDITIONAL NET PROCEEDS OF MINES AND PROPERTY TAXES WILL ONLY SERVE TO MAKE EVEN BETTER A WONDERFUL COMMUNITY OF WHICH RMGC IS A WELCOME PART. MINING IS THE BACK-BONE OF THIS COMMUNITY, AND WE ARE PLEASED AT THE FINANCIAL COMMITMENT MADE TO US BY ECHO BAY.

Response to Letter 15

15-01 Comments noted.

Transcript 16

BEFORE THE BUREAU OF LAND MANAGEMENT

PUBLIC COMMENT MEETING

Round Mountain Mill and Tailings
Facility Draft EIS
_____/

Tuesday, October 17, 1995

Donald L. Simpson Community Center
Hadley, Nevada

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Reported by: ERIC V. NELSON, CCR No. 57

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Transcript 16 Continued

APPEARANCES

For the Bureau of Land Management:	CHRISTOPHER J. STUBBS Planning and Environmental Coordinator
For Round Mountain Gold Mine:	PETE KESL Operations Manager
	DUANE WHITING Environmental Manager
For Riverside Technology, Inc.:	VALERIE J. RANDALL Director - Environmental Assessment & Permitting
	PATRICK S. PLUMLEY Senior Engineering Geologist/Hydrogeologist

I N D E X

PUBLIC SPEAKERS:	PAGE:
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Paul Dimartini	3
Dave Harris	5
Richard Carver	6

Transcript 16 Continued

HADLEY, NEVADA, TUESDAY, OCTOBER 17, 1995, 7:04 P.M.

-oOo-

(Whereupon, a presentation was given by the Bureau of Land Management and Gold Mountain Mine.)

MR. STUBBS: At this time I'd like to ask our reporter to start taking a transcript of everything that's said.

Folks, it is a big room. So when you have a question or a comment, if you can please stand and speak loudly.

If that doesn't work, I'm going to have to ask you to come forward. I'm hoping that we can do it from the chair so that Eric can hear.

If you want to stand, state your name, spell your last name, and tell us if there is any affiliation, and give us your comment or question.

So at this time I'd like to hear from you, please. Any issues, questions, concerns, dreams?

FROM THE FLOOR: This is the first time you pulled this off, Chris. No comment.

MS. MCCRACKEN: My name is Ann McCracken, M-c, capital C-r-a-c-k-e-n.

And I'm concerned -- first of all, I'm a resident of Round Mountain. And I'm concerned about the

Transcript 16 Continued

impact on the schools, what's the proposed population growth, the proposed student growth, and if the School Board has any -- if they are prepared to respond to the growth.

16-1

MR. STUBBS: Thank you, Ann.

Pete, would you? I'm going to ask Pete Kesl, folks, to address that question. He's got a better handle on some of those issues than I do.

MR. KESL: Yes. We have been working very closely with the School District on this issue. The mill will bring in approximately 40 to 43 more employees. So that doesn't equate to too many kids, I don't think.

But the school can handle anything we have got. Now that we have consolidated and added to it, it's large enough to handle it.

MS. MCCRACKEN: Pete, does that include the construction period?

16-2

MR. KESL: I don't think you will see a big impact in school construction. Most of them are in here in camp trailers, and the families don't come. The jobs they come in for are 30, 60, 90 day type jobs.

There will be a concrete crew come in and leave, there will be a construction crew come in for ironworkers and leave. There will be a dirt contractor come in and work on the tailings pond, which hasn't

Response to Transcript 16

16-01 Potential impacts to schools are addressed in Section 3.12.2 of the Draft EIS and Final EIS. Depending on the ages of school-age children in the families of the new operational work force, there may be a shortage of classrooms for junior-senior high school students. The Smoky Valley Common Operation will continue to work closely with the school district to monitor and address the situation. As indicated in Section 3.12.4 of the Draft EIS and Final EIS, an additional modular unit could be added, if necessary.

16-02 As indicated in Section 3.12.2 of the Draft EIS and Final EIS, impacts to schools are not anticipated during the construction period.

impacted us much for kids in our schools.

MS. MCCRACKEN: Thank you.

MR. STUBBS: Ann, does that answer your question?

MS. MCCRACKEN: Yes, it does.

MR. STUBBS: I forgot to point out, any comments tonight will also be considered in the Final EIS, and if you have a real technical comment or question, I may defer it until we have time to think about it and answer it in the Final.

But let's proceed. What else? Ann, that was a good question.

Anybody? Surely there are some other points to be made.

MR. WHITING: They can make positive comments too.

MR. STUBBS: Yes, sir.

MR. DIMARTINI: I'll make a positive comment. Paul Dimartini, D-i-m-a-r-t-i-n-i.

And I'm the president of D & D Tire, Incorporated. I live in Tonopah, Nevada.

And give you a brief little history about my company, which started with four people in February of 1983, and one of our first customers was Round Mountain Gold Corporation. So some of the people that are here,

Transcript 16 Continued

Pete particularly, I have known as long as I have been in Nevada. Even before I started my company.

And Round Mountain Gold has been the single largest catalyst in the growth and success of our company, which currently employs roughly 60 employees, 35 of which are in Nye County. Twenty of those live in Tonopah, which anyone that is familiar with Tonopah these days knows is pretty depressed. Matter of fact, it's as depressed as I have seen it in the 15 years I have been here.

So I'd like to make it clear, and I'm sure it's in the Draft, which I apologize for not having read yet, that the Environmental Impact Statement I know addresses economic issues, the dollars that are spent by Round Mountain Gold that are kept in the local community, particularly Nye County, are almost intangible, I would think.

Our company is a good example. I suspect that we're in the top five, for sure the top 10, largest suppliers of Round Mountain Gold, without knowing that for a fact, but I'm sure we're in that, and the dollars they spend with us that are kept in the community, like payroll and stuff, particularly in the case of the condition of Tonopah right now, are just a great boom to the community, which is, as I said, depressed.

Transcript 16 Continued

16-3

So anything anyone can do that's going to benefit Round Mountain Gold is not only going to benefit this area right here in the valley but lots of other areas in the county and the state.

It's allowed my company to grow, and we're statewide now and actually in California. A lot of that has to do with the support we have had from Round Mountain Gold, and we give them our full support in every endeavor. We're looking forward to the expansion. Thank you.

MR. STUBBS: Okay. Thanks for that comment.

There must be more. Is there a hand back here?

Yes, sir. Please.

MR. HARRIS: Dave Harris. I'm a high school teacher, AD at the high school.

16-4

Round Mountain Gold is very supportive in the school here in Round Mountain by money, equipment, support, as well as giving tours, educationally. They have been a very good neighbor and very supportive. And the school that we do have here in Round Mountain, a lot of it is due to Round Mountain Gold and its support for education.

MR. STUBBS: Okay. Thank you.

More questions or comments from the

Response to Transcript 16

16-03 Comment noted.

16-04 Comment noted.

audience? Now is your chance.

Also tomorrow night in Reno we're having a meeting at seven o'clock at the Airport Plaza Hotel, a similar meeting.

We're getting close here, we'll close out if I don't have anything else from anybody.

MR. CARVER: I'm going to come up there, Chris. I'm running out of voice tonight.

MR. STUBBS: Sure.

MR. CARVER: I'd like to turn it on so I don't have to talk so loud.

I would like to welcome everybody here tonight, especially our BLM friends. You might think it's kind of weird to hear from me, but you railize that government has to continue on even if we disagree on ownership of the public lands out there. But I have got some concerns, and I wanted to let you people know exactly where we stand.

First of all, as a County Commissioner, I think that I represent the second largest commissioner district in America, and it is the best commissioner district in America, and it is the best county in America. So I'm proud of it. That it's you people that make it that way. I'm just proud to be a Commissioner representing you.

Transcript 16 Continued

What I'm here tonight to tell you may or may not be the positions of the County Commissioners, but I'm going to tell you that generally I have about 110 percent support from the other four Commissioners.

I'm very disappointed in the process here, but I want to compliment Round Mountain Gold and especially Pete and Duane and the crew up there because they have done an outstanding job in the community. I support the project, and so does Nye County, 100 percent, and we will do anything possible to get it on.

The disappointing thing is that back in 1993, we met at the Airport Plaza in Reno, and Chris was there, and several of the people, Duane was there also, and I requested that we as a county be involved at the table, and as you saw up here on the slide, they involved the BLM, the mine, and the environmental group. Nye County wasn't at the table.

In February the 5th of 1992, we sent a letter to the Forest Service and to the Bureau of Land Management and asked them in writing to be involved in all land use planning decisions. By Code of Federal Regulations, 43 CFR 1610.3, gives Nye County the position at the table to be involved. We have to know what's going on.

The reason we have to know what's going on

is because, for instance, if this was a new mining operation, we wouldn't know what was going on until tonight. We need to know what's going on two or three years ahead of time so we can be planning ourselves.

I can tell you that if Nye County would have been invited to be at that table, it would have probably been somebody out of the planning department because we as Commissioners don't have the time to do it. Again, right here in Round Mountain, we requested to be at the table, and at the Tonopah Commissioner meeting, when you came in there, we said we want to be involved.

Ladies and gentlemen, it's sad but we never received a postcard or a call, never any involvement in any way.

I'm here to tell you tonight that we're not here to shut this EIS down on this project. It is a go, we're going to back it 100 percent, but we're not going to tolerate it again. If they don't involve us the next time, and I don't care if it is Round Mountain Gold or the Bureau of Land Management, when the EIS is completed, we're going to challenge it, and we're going to stop it. We're going to start it all over again because we have that position. And we're not afraid to challenge the federal government.

We realize that the federal government has

Transcript 16 Continued

exclusive jurisdiction out here on federal property. But our position is this is not federal property, this is your property, and I'm damn well ready to give up my life to make sure that mining is here forever, that livestock industry is here forever, and we have recreation out here.

The problem is in America today, we are governed by bureaucrats that work for us in appointed positions, and right here is a good example, they haven't followed the regulations, they have taken control away from your county government that you elect, and they have run over the top of you.

I can tell you, I don't blame the mining companies today for going overseas, for having to put up with crap like this, and I'm not going to allow it to happen in Nye County again.

It is sad that all the money that was wasted here couldn't have gone for salaries for you people that work at the mine. In the two or three year period it's been wasted.

It's sad to say that they had to go in to put in a 615 acre pond on, quote, public lands, they had to spend several million dollars to go through three years of bullshit, and we're not going to tolerate it any more, Chris.

Nye County in this process through our scoping process and meeting we had in the Commissioners chambers. It's a concern to me that the cooperation between the BLM and Nye County is being viewed as inadequate. And what I'd like to do is work with you outside the purview of this meeting to rectify that. We can talk about it in more detail.

The other point that I'd like to speak to is the dewatering issues. We looked at impacts of dewatering and of the leach offload piles because those issues have never before been analyzed in a NEPA document, never been revealed to the public, and we have certain organizations that were interested in seeing that analyzed. In addition -- well, like I said, it was an issue that hadn't been looked at before and there were concerns. That's why we dovetailed it into this EIS.

In terms of the land ownership issue, that's pretty much out of the purview of this meeting. And so I can't address that here.

Other comments?

MR. CARVER: Chris, I just want to make it clear about your involvement with Nye County. I have to be the first to admit that they have tried to involve us just like any other public -- the public, and that's not what we're talking about. We realize we have that

Transcript 16 Continued

opportunity. But that's not the issue.

The issue is we have a right to be at the table from day one until the day the final paper is put out. That's what we asked for, not the public input part. Because we just want to know what's going on.

MR. STUBBS: And I'm not sure if he was identified when he stood up. That is Richard Carver, Nye County Commissioner. He's probably the only guy in the room that doesn't know you.

Questions, issues, concerns? We have had a good discussion so far. Do I need to close it out now?

Going once.

MR. CARVER: Chris, I'd like to address Ann's issue about the school.

MR. STUBBS: Sure.

MR. CARVER: The increase in production will far more than offset the money that goes into Nye County School District and the county, that there will be more money per student in the entire county just because of this mill operation than what you have got right now.

Let me tell you another thing. It's because of this mining operation right now that Nye County is not bankrupt. This mine right here is carrying the weight of Nye County, and I'm proud of it.

And the Hadley Subdivision right here is the

finest subdivision that we have in the entire county. And we had the Commissioners here today, and they were very proud of what we have.

MR. STUBBS: Thank you. I thought I saw a hand.

Any other hands? Questions? Going once.

Okay, folks. I appreciate your attendance tonight. If you want a repeat performance, it's Reno tomorrow tonight.

Remember, the comment period closes on November 22nd. You are welcome to leave your comments in the back of the room.

If you didn't sign in when you came in, please do on your way out. And thank you very much. Have a good evening.

(Meeting adjourned at 7:53 p.m.)

-oOo-

Transcript 16 Continued

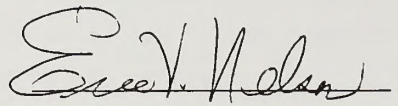
STATE OF NEVADA,)
) ss.
COUNTY OF WASHOE.)

I, ERIC V. NELSON, Certified Shorthand Reporter and a notary public in and for the County of Washoe, State of Nevada, do hereby certify:

That I was present at the Public Comment Meeting of the BUREAU OF LAND MANAGEMENT on Tuesday, October 17, 1995, and thereafter took stenotype notes of the proceedings, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript is a full, true and correct transcription of my stenotype notes of said proceedings.

Dated at Reno, Nevada, this 25h day of October, 1995.



ERIC V. NELSON, CCR #57

SIERRA NEVADA REPORTERS (702) 329-6560

finest subdivision that we have in the entire county. And we had the Commissioners here today, and they were very proud of what we have.

MR. STUBBS: Thank you. I thought I saw a hand.

Any other hands? Questions? Going once.

Okay, folks. I appreciate your attendance tonight. If you want a repeat performance, it's Reno tomorrow tonight.

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(Meeting adjourned at 7:53 p.m.)

-oOo-

Transcript 16 Continued

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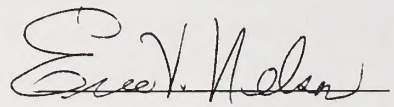

ERIC V. NELSON, CCR #57

SIERRA NEVADA REPORTERS (702) 329-6560

Transcript 17

BEFORE THE BUREAU OF LAND MANAGEMENT

PUBLIC COMMENT MEETING

Round Mountain Mill and Tailings

Facility Draft EIS

_____/

Wednesday, October 18, 1995

Airport Plaza Hotel

Reno, Nevada

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Reported by: Cindy Lee Brown, CCR #486

Transcript 17 Continued

APPEARANCES

For the Bureau of Land Management:	CHRISTOPHER J. STUBBS Planning and Environmental Coordinator
For Round Mountain Gold Mine:	PETE KESL Operation Manager
	DUANE WHITING Environmental Manager
For Riverside Technology, Inc.:	VALERIE J. RANDALL Director - Environmental Assessment & Permitting
	PATRICK S. PLUMLEY Senior Engineering Geologist/Hydrogeologist

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Dick Carver	20

Transcript 17 Continued

RENO, NEVADA; TUESDAY, OCTOBER 18, 1995; 7:00 P.M.

--oOo--

(Whereupon, a presentation was given by the Bureau of Land Management and Round Mountain Gold Corporation.)

MR. STUBBS: When you have a question or a comment, even if it's brief, please, stand, state your name, and spell your last name.

Even if everyone else in the room knows you, Cindy probably doesn't, and she's the one that's got to get this down. If I can't hear you, it means she can't hear you, and I'm going to ask you to speak up.

I would remind you that you can send your comments to the BLM, written comments. That's fine. You can put your comments with name and address on the forms at the door, or you can give verbal comments at this time.

Questions of a highly technical nature, I'm going to put off and answer in the Final EIS. We're not trying to not answer your questions; we simply want to take time to formulate a completely accurate answer, and that will be done in the Final.

So at this point, I'd like to hear from you. I'm sure that several of you came with the intent of at least saying something.

Please, you can just stand right there. If you could, just name and rank and serial number.

Transcript 17 Continued

MR. MILLER: My name is Glen Miller, and I appreciate the opportunity to comment on the EIS. I will submit written comments later on, but I would like to make a few general comments about the EIS. I appreciate the amount of technical work that went into it, and I know the staff of the BLM and the consultant firm have spent a fair amount of time.

There's four issues I'd like to cover. First of all, one of the tests, the primary test used to examine spent leach ore water quality;

The second issue is one of the modeling efforts of the pit lake geochemistry;

Another issue is on the potential for groundwater contamination;

And the last issue is on the validity of the wildlife testing, mostly as a function of the pit water quality.

The EIS discusses the drainage potential from spent ore and uses a test called the meteoric water mobility test. And this test is one that I believe is basically not a valid way of assessing the drainage quality of water.

17-1 What the real issue is in assessing water off a spent material, is to determine what quality of drainage water will come off. What the meteoric water mobility test is, tests what quality of water would be in a very, very

Response to Transcript 17

17-01 Please see the response to comment 09-16 regarding the Meteoric Water Mobility Procedure.

Transcript 17 Continued

17-1

shallow amount of that material as rain flows down through the surface of it one time and goes through that spent ore and comes out in the bottom. It does not give you any handle on either how much total material is mobilizable, nor does it give us any idea of what the quality of water would be as it drains down through the top of the heap.

And there's a lot of decision making that went on in the basis of this meteoric mobility test. And I know there's laboratories in Reno right now that have gone through and tried to make the test standard. But I'll argue that the basic premise of that test is invalid. It is not a good predictor for drainage water quality.

17-2

The other tests that I think are a lot better are EPA 1312, which uses a larger amount of water to dilute the sampling, and then you can just bring those concentration of contaminates back to what you find on the rock.

I said this to BLM before, and I hope somebody will listen because this is a bad test. And the state, I think, was in a position of almost changing it awhile back. They have now come back to accepting it.

But it does not -- If you ask yourself what does this test really tell us in terms of what quality of water will be draining out of this heap now and 100 years from now, it doesn't give you any information at all, other than to say that in a very general sense, arsenic is going to

Response to Transcript 17

17-02 Please see the response to comment 09-16 regarding EPA Method 1312.

Transcript 17 Continued

be a problem; saline is going to be a problem. But in terms of total amount of loading, it does not help at all.

The second issue is the issue of pit water modeling quality, pit water quality modeling. This is an issue I've been interested in for several years, and I've commended PTI previously on some of their pit water quality tests.

But I think that the sum of the statements in the EIS, and I have to admit that I was trying to get the documents that Duane -- Steve Botts from Echo Bay brought to the UNR. Those documents have been checked out. I will look at those in more detail. So really all I looked at in detail was EIS.

17-3 But throughout the pit water quality modeling's study suggested that very conservative assumptions were used on the pit quality, that it will not be worse than this. And I guess I would argue that in fact it very definitely could be worse than that. All the set of criteria we used initially for this modeling effort was one particular set of modeling criteria. There is a very, very large range of criteria that could be used in initial assumptions.

17-4 And I would also caution any kind of model that predicts with three significant figures or even two significant figures out to 300 years. There is no basis for that whatsoever, and I know PTI is very concerned about doing

Response to Transcript 17

17-03 Please see the response to comment 09-03 relative to the conservative nature of the analysis.

17-04 Please see the response to comment 09-01 relative to future predictions.

Transcript 17 Continued

17-4

something like that. There is a deal never to ask for that because it simply is meaningless. It has no basis in reality at all. We cannot model a year ahead with two significant figures. We cannot model two years ahead with two significant figures. 300 years is --

But I can generate a scenario that actually has poorer quality water that exists with as much validity than exists with the data that exists here. For example, one can say that if you're dewatering the pit, you're binging down the water leveling and exposing a lot of rock to oxygen that has not seen oxygen for many years. So you're exposing sulfide material all the way down until you stop dewatering, but that means that probably several million tons, several hundred million tons, of rock are exposed to oxygen.

How much surface area that is, I have no idea. But now you've got a wet rock that is exposed to oxygen in a

17-5

damp environment, and you can have a lot of oxidation occurring there. So that when that pit initially begins to refill, it flushes all that material into the pit because it clearly is going to flush. It is going to be a dramatic thing as that water fills. The first water you see is going to be very poor quality. There's actually data to support that.

The center in south pits of the Getchell mine began filling. I think that was discontinued sometime in the

Response to Transcript 17

17-05 Please see the responses to comments 09-03, 09-05, 09-06, and 09-07.

Transcript 17 Continued

sixties. In 1968 there was water collected from this pit. And the water quality initially in 1968 had a Ph of -- Well, in the south pit it had a Ph of 2.97, a very high sulfide concentration, high TDS. The metals data were not there, except that it had a 12 milligram read of iron, which is a higher iron content.

17-5

The center pit was about the same quality of water with the Ph 3.5. And it had a high TDS right off the bat. And then it began to rise, and it began to interact with carbonate rock, and the Ph rose. So the situation was a lot of material flushed in right away.

The second thing that the assumptions in here that I think are probably not -- At least I can choose another set of criteria, is that assume that all oxidation stops when the pit is flooded, and it also assumes that the pit is completely aerated. Both of those assumptions may be valid.

17-6

On the other hand, in your modeling out 300 years, I can almost guarantee that you're going to get in a certain amount of oxidation of any sulfide material in that particular area.

The bottom line is, if you are going to have an aerated water body, you can have a lot more oxidation over decades, and the concentration of materials can actually go up, arsenic, whatever.

Response to Transcript 17

17-06 Please see the response to comment 02-02 regarding sulfide oxidation.

Transcript 17 Continued

The assumption of a completely aerated water body is so questionable. We have done some work on Yerington pit that one is completely aerated; it had some oxygen decline. But it is well mixed, and so in that case would be consistent with this. That it's aerated.

On the other hand, the Getchell pit, which was a hundred feet deep -- and I think this was 1985 data or thereabouts -- shows a very dramatic stratification of 100 feet. In that case that didn't mix. So I bet you would find some very clear oxidation differences as you go down.

17-7

And if the oxygen is not present in that pit, you are not going to have, you're simply not going to have iron dragging out the arsenic. You are going to have a lot of arsenic redissolve.

And the last assumption is that the only inflow in there over the long-term is from underground water, and the iron in there is going to pull out the arsenic. So that arsenic we'll find in 300 years exists.

17-8

There is no reason to believe that that is going to be completely mixed when one could also argue that the rinse off on the sides of the walls of the pit is going to be a continued input of contaminates into the lake. This is not the most conservative pit-lake water model. It's one of many models. It is an untested theory.

17-9

Other than the fact that I think that overall

17-10

Response to Transcript 17

17-07 Please see the responses to comments 09-05, 09-06, and 09-07.

17-08 The meaning of this comment is unclear; therefore, the BLM could not respond.

17-09 The model includes the assumption that there will be continued contaminant input from the exposed pit walls.

Transcript 17 Continued

17-10

the modeling does suggest that the water quality is going to be fairly poor, which is consistent with the kind of geology that exists in this case, if that is the case and saline is one of the contaminates, I believe the standard that the list is 50 parts per billion is incorrect for the standard. In Nevada it's actually 10 for domestic life, and the protection of aquatic live is 20 parts per billion. So there's a factual error.

17-11

I think that may affect some of the aspects of whether it meets or does not meet water quality standards. But with that range of uncertainty that exists in the pit water model, to do a risk assessment without talking about a range of alternatives, I think is very risky. It is truly taking a very, very shaky model with a high degree of uncertainty and basing a whole large set of other determinations, each of which also have a high uncertainty. So your errors bloom out until you really have no basis of doing anything very quantitative.

17-12

I have a conflict of what you do then, but I think the way that the document is presented now suggests that there is a fairly high level of certainty of worst-case scenario. This isn't going to be a problem. And I think that is very questionable.

The last issue, the last two issues that I would bring up, hopefully briefly, and I apologize for the

Response to Transcript 17

17-10 It is assumed that the constituent referred to in the comment is selenium. For selenium, the current Nevada Primary Maximum Contaminant level established to protect human health is 0.05 milligrams per liter as stated in the Draft EIS. Please also see the response to comment 09-09 regarding selenium concentrations.

17-11 The Final EIS has been revised to acknowledge the uncertainties of model predictions (see Sections 3.2.2 **[page 3-54]** and 3.5.2 **[page 3-85]**).

17-12 The pit lake geochemistry and risk assessment were conducted using realistic data and assumptions where possible. Where a range of parameters exist, environmentally conservative values were used. However, no attempt was made to perform a worst-case analysis.

Transcript 17 Continued

time, is that the issue of contamination of groundwater. Again from the Getchell, or this is actually is the Boss pit -- This is other data from the pit lake -- suggests that water in wells near the pit, the spot which is located somewhere similar, southwest of Round Mountain, have contaminated water.

Now, I'm not sure what the location of those wells were, but there are data that suggests that within the time frame, the Boss pit's existence, there is -- There has been wells that are fairly heavily contaminated near that site. Whether it was contaminated with pit water, I don't know.

But if you are going to model out 300 years and see the slow, steady decline of arsenic, which frankly I have a fair amount of difficulty agreeing with, you could also model the diffusional aspects of that pit lake model just from high concentrations. You are going to get high diffusional ratings, if, assume that the water in the pit is bad, which it clearly, I think, is going to be, I agree with the overall -- With saying all those things, I agree with the overall assessment of PTI.

17-13

I guess I'm arguing with some of the specifics, but if you agree that the water quality in the pit is of poor quality and then you say that it's not going to migrate because it's in that sink, you're making a discontinuous

Response to Transcript 17

17-13 Please see the response to comment 09-13 regarding diffusion.

Transcript 17 Continued

barrier, an imaginary barrier between the pit water and the groundwater.

Simply by diffusional processes you are going to get migration of contaminates from the pit lake into the groundwater. That groundwater does meet drinking water standards right now. If you get that migration from the pit lake into groundwater and you model it -- If you're going to model one, you better model the other and diffusion is a whole lot easier to model. You'll find at some point that in fact you are contaminating groundwater.

I don't have any real doubt about that. But I think that point ought to be made very, very clearly, that if you have a pit lake with bad water, some of it's going to migrate. It appears to have migrated at Ruth and Liberty. I mean there's a lot of sulfide downgrading; the same thing with the Boss pit.

17-13

There are data that are supportive of the fact that pit water does migrate, even though you can say it's in that sink. There's more water that goes in by infiltration and evaporates. There is some migration.

I think that to state unequivocally, and this is really a critical issue because it is illegal to contaminate groundwater, and to reduce the use of groundwater, I believe this pit is going to contaminate groundwater. And I believe this is a regulatory issue that

Transcript 17 Continued

17-13 the BLM and the state should really face. Because if you model one, you better model the other. And I bet it's going to show that you get some groundwater quality problems.

And therefore, under the current Nevada law, this pit should not be allowed, under current law.

MR. STUBBS: I want to make sure everyone else has a chance.

MR. MILLER: Often times I'm the only one that talks.

17-14 The last issue is one of the question of wildlife. And with my reservations, as far as the pit water quality modeling, and it's just one set of, one set of input parameters. There is a statement in the EIS that the water quality has the potential. Round Mountain pit lake may cause long-term impacts to individual waterfowl, as well as population impact.

The wording in the state law is that the water body created by mining shall not have the potential to adversely affect wildlife. It would suggest then that again this pit lake should not be permitted because of current state law.

17-15 The last point I'd like to make, and this is a general point. This is the first pit lake that did not exist previously -- This excludes Ruth and Liberty -- that is almost certainly based on modeling, and I have great respect

Response to Transcript 17

17-14 All chemicals predicted to be present in the pit lake 330 years following closure of the mine except zinc will be below levels that could cause adverse effects to wildlife. Because of the uncertainties in the magnitude of the bioaccumulation and the concentration of zinc in pit lake water, the actual exposure of dabbling ducks (represented by mallards in the ecological risk assessment) at 330 years postclosure could range between 0.69 and 11 times the lowest-observed-adverse-effect level for mallards exposed to zinc. In addition, it is uncertain whether and to what extent habitat for dabbling ducks will develop in the pit lake. Because the shores of the lake will have steep sides subject to rapid erosion, the extent of habitat development is likely to be small. In the context of these uncertainties, the magnitude of effects on populations of dabbling ducks in unknown, but is likely to be minor.

Given the level of certainty in the results of this risk assessment and the severity of predicted wildlife impacts, the BLM does not consider the pit at the Round Mountain Mine to be in violation of the Nevada Administrative Code. As stated in the response to comment 01-01, postclosure monitoring at the Round Mountain Mine, as required by the Nevada Division of Environmental Protection's Water Pollution Control Permit, will determine actual water quality trends. At that time, the need for mitigation will be developed based on the Nevada Administrative Code, the Clean Water Act, and best management practices, rather than on predicted long-term impacts to wildlife which have a relatively high degree of uncertainty and questionable severity.

Transcript 17 Continued

+for PTI. And I think the modeling effort was, in general, quite good. But it is almost unambiguously going to have a poor quality of water.

17-15

This is almost a precedent-setting action by the BLM and the state that the first pits, that there is modeling efforts that show that it's going to have poor quality of water. And that it is going to be reduced from what is now drinking water to water that does not meet drinking water standards, it doesn't meet irrigation standards, it doesn't meet livestock watering standards, and it would probably not even meet a lot of industrial standards.

17-16

So it's taking good water from bad, and it's 25,000 acre feet of water. That is a lot of water out there. That's the pit volume. That's the same volume as what the Berkeley pit has in it right now. That's a lot of water. It is forever going to be condemned from multiple uses, and it has a fairly high likelihood that it is going to contaminate groundwater.

17-17

It is a precedent setting issue I think the Bureau and the state agencies need to take a long hard look at because there is a whole lot of other pits coming up. And if the decision to go with this pit as under the current staff. Watch. People will wonder 30 years, 40 years from now, Gees, guys, I wish to hell, I wish those guys would have

17-18

Response to Transcript 17

17-15 As stated in the EIS, modeling indicates that the pit lake would not discharge to surface or ground water. Therefore, the development of the pit lake is not expected to degrade surrounding surface water or ground water resources. Ultimately, the pit lake would become a water of the State of Nevada. Applicable water quality standards for the lake at that time would depend on the potential beneficial uses of the lake. Since the lake is not anticipated for use as a drinking water supply for humans or livestock or used for irrigation purposes, standards established to protect these beneficial uses do not apply to the lake water.

17-16 Please see the response to comment 17-15.

17-17 Please see the response to comment 17-15.

17-18 The BLM reviews mining plans of operations in which there will be an open pit beneath the ground water table on a case-by-case, site-specific basis. Hydrogeologic and geochemical modeling are the best tools at our disposal to predict future conditions in the pit; as such, this is not a precedent setting action. (See the response to comment 17-15).

The BLM does not believe that the conditions that exist at the Berkeley Pit lake in Butte, Montana, are similar to conditions that exist or may exist in the future at the Round Mountain mine pit lake. Comparisons between the Berkeley pit lake and the Round Mountain pit lake are irrelevant.

Transcript 17 Continued

17-18

done something different 40 years ago. The same thing people think about the Berkeley pit, "Gee, I wish they would have done something different 40 years ago."

But we are here doing today in Nevada the same thing they did 40 years ago in the Berkeley pit and the Berkeley pit was a whole larger set of criteria and a whole larger set of problems and is a long-term expense. I think there's a real problem here. Thank you.

MR. STUBBS: Thank you, Dr. Miller.

Just for the identification for the court reporter, that's Glen Miller, M-i-l-l-e-r, with the University of Nevada in Reno.

MR. MILLER: No. I'm with the Sierra Club.

MR. STUBBS: With the Sierra Club. Excuse me.

These issues will be considered and discussed in the Final EIS. They're beyond the scope of what we can talk about here tonight. I just want to quickly summarize.

Dr. Miller has concerns about the validity of the meteoric water mobility tests. He has concerns with numerous issues surrounding the pit lake and the result water quality of the pit lake, in addition to how that pit lake was modeled.

He feels that the risk assessment is likely based on faulty assumptions because of our lack of confidence in the pit water model. And there are concerns about impacts

Transcript 17 Continued

to waterfowl and how that relates to legal mandates.

Does that more or less -- Okay.

MR. STUBBS: Thank you for your comments. I'd like to continue on and hear from other folks in the audience.

MR. Scheidig: I'm Paul Scheidig. That's S-c-h-e-i-d-i-g. I'm Director of Resource of Environmental Affairs for the Nevada Mining Association. And the Nevada Mining Association represents nearly 500 members interested and involved directly in mining in Nevada.

And one of our honored members is Round Mountain Gold Corporation and Echo Bay Mines. We're very proud to have them in our membership because I think that they have demonstrated -- Lost my wording -- you know, the quality, a good quality of mining and environmental ethic over the years that they've existed in the location of this property.

And I think the expansion of this particular mine and the proposed, obviously the proposed project, in this Environmental Impact Statement, EIS, is one that will benefit Nye County in a very favorable economic way.

It certainly will benefit the mine, and I think our nation. In fact the gold is one of our net export items that many people fail to recognize these days, but it did help us in our balance of trade. And there are a number of

Transcript 17 Continued

other national and local economic benefits.

Notwithstanding those items, the thing that's notable about this particular expansion is that it's an expansion of an existing mine. One that is not necessarily, with one minor exception in the tailings facility area, is going to more or less tread onto new ground. Most of the facility is going to be built on existing ground and not necessarily impact the environment nor the area in any adverse or environmentally detrimental fashion.

17-19 In fact, I think it should be noted in the Final EIS that the expansion, this proposed action in particular, in no way, shape, or form appears to have any real effect or negative impact on pit water quality or the level of the environmental degradation for wildlife or any other standpoint in this particular area.

If this expansion were not to go forward, the same issues that were raised in this particular EIS would still be there, and I think have been very well, favorably addressed, as well as scientifically addressed by the consultants of Round Mountain Gold as well as the consultants that drafted the EIS for the Bureau of Land Management.

Notwithstanding previous comments, you know, the meteoric mobility test is one that the Nevada Mining Association has embraced as a good methodology of assessing meteoric environmental condition of a particular heap or

Response to Transcript 17

17-19 Comment noted.

Transcript 17 Continued

waste-rock area, and can be a very good predictor of effluence and potential environmental degradation over time.

And at this particular facility and other mines around the state other methodologies are available, and some other mines do use those. But the standardization of the meteoric water mobility test is one that I think will prove to be a very solid, reasonable test, and one that is really very conservative over the EPA methods that are available and a much more sound way of analyzing the environment.

17-20

I would caution the Bureau in looking at other comments on the sort of side issue of pit water quality and groundwater quality that have been analyzed with regard to using other sort of examples that appear to be apples and oranges in the same sort of basket. There's a lot of evidence out there and I think PTI did a very good analysis of this pit water, and it should stand on its own and not necessarily have to meet up or measure up with other examples that you may receive from commenters that would appear to demonstrate a different sort of scenario.

What they have done is very solid, very sound. And I know that Round Mountain Gold has gone well beyond the normal sort of posturing or extent to make sure that they've covered every base, and have done a full, complete analysis of that particular issue.

Lastly, in conclusion, you know, I again, I'll

Response to Transcript 17

17-20 Comment noted.

Transcript 17 Continued

comment that the Nevada Mining Association supports the proposed action. That the proposed action is one that should go forward, be approved, and not be swayed, or the decision be altered in any way as a result of other peripheral issues, such as poor water quality. 17-21

MR. STUBBS: Thank you, Mr. Scheidig.

Who else do we have tonight that has input? I'm sure there is a reason some of you are here.

MR. MILLER: May I make another statement?

This is an issue I've actually discussed with PTI. And I think it has as good a handle on this as anyone.

If there are other pits available that exist that have water in them, that has -- that they come from gold mines, which both the Boss mine and the Getchell mine were gold mines, and they have data that suggests something different than what was modeled. The modeling results that have developed really are, they are based on scientific theories of geochemistry which are valid but incomplete.

And if we cannot model a pit that has been dug and filled up with water, two pits, and they show something different than what the modeling efforts do, which do we agree with? Do we think that the modeling is correct, which is basically a mathematical conclusion? Or do we use sets of data that exists? 17-22

I'm arguing that the data that we have from

Response to Transcript 17

17-21 Comment noted.

17-22 Please see the responses to comments 09-05, 09-07, and 09-08.

Transcript 17 Continued

17-22 Boss mine and Getchell mine, it's not good data. It is not the way I would have liked to have them collect the samples. But it is data and it shows disturbing things that are inconsistent with these mines. And if we cannot use existing data as a better gauge of whether this model is correct, then I think we are here really fooling ourselves. Data is better than models. And I model things at my job, and I can tell you, if you don't have data to hang onto, then you are blowing smoke.

MR. STUBBS: Thanks, Glen.

Who else?

MS. SILL: I'm Marjorie Sill. I'm neither a scientist like Glen or an environmental consultant like Paul. I'm an ordinary citizen. But in reading over some of the material here on water, and particularly on what the effect of the mine dewatering would be, I find a couple of statements here that concern me because I'm not quite sure what the certainty is of what is being said.

17-23 In the first place, I notice that the Round Mountain town site water supply consists of a mixture of groundwater withdrawn from one of the wells and spring water captured at Healy and House springs. The -- Evidently from the numbers, which are quoted, it is felt that this will not have effect on the supply for the citizens of Round Mountain, the water supply.

Response to Transcript 17

17-23 Mitigation measure WR-1 provides specific monitoring and mitigation measures for potential effects to the Round Mountain townsite well. It should be noted that the majority of people that previously lived in this town site have been relocated to the community of Hadley.

Transcript 17 Continued

17-23

But in an area where there are only seven inches of rain per year, water is -- I mean it's the life-blood of any community, not only the human community but the wildlife community. And I would like to see a little more certainty about what is said here.

17-24

It says, "Considering the close proximity of the well to the pit and the complex hydrogeologic conditions in the area, the water levels in the water-supply well located within the Round Mountain town site should be monitored."

And I would say that this monitoring has to be very carefully spelled out because if you have a condition which develops as far as the mine dewatering, and it actually affects the well of the Round Mountain, the water supply of the Round Mountain people, this is going to be a very, very serious thing.

17-25

In addition, the impact on springs and stream base flow, it quotes the fact that the predicted 10-foot drawdown contour would affect Healy spring, and the lower flowing reach of Jefferson Canyon, which is 2500 feet north of the predicted drawdown.

And it concludes, "Therefore, mine dewatering is not expected to significantly impact surface water resources." I would like something far stronger as a statement there, because when we say, "significantly," I'm

Response to Transcript 17

17-24 Please see the response to comment 17-23.

17-25 With respect to the 10-foot drawdown contour, this comment is incorrect. The EIS clearly states that there are no perennial water source areas, including springs and streams, located within the area delineated by the predicted 10-foot drawdown contour. Also, please see the response to comment 01-06.

Transcript 17 Continued

17-25

not quite sure what is meant there. And could it have an affect on the springs and particularly on the wildlife of the area that depends on those springs?

So I would like to see these issues addressed, please. Thank you.

MR. STUBBS: Thank you for your comments, Marjorie Sill.

Like Dr. Miller's comments they're fairly technical, and I would like to respond to those in the Final. However, we appreciate your input.

Do I have anybody else? We've got a good one going so far. Comments from anybody else in the audience, questions? It's your chance to be heard.

MR. CARVER: I'm going to come up and use the mic, because I don't want anybody standing up behind me. They might throw something at me.

I'm surprised that Chris will let me speak tonight. But my name's Dick Carver. I'm the Nye County Commissioner. First of all, I'd like to thank Chris for allowing me to speak tonight after I got on him a little bit last night. Pete and Duane didn't tell me to stay home so I'm here.

I think first of all I'd like to thank my little bride, and I'd like to have her stand up and introduce her, my wife, Midge. I want her to be thanked because she's

Transcript 17 Continued

always behind me to support me. And it's very nice to come here tonight and run into one of my classmates when I was in grammar school. Larry, I'd like you to stand up. Larry Turk. Him and I went to grammar school together.

But Midge and I started grammar school in Round Mountain -- How many years ago? 1949, 1950, and the mine was in operation at that time. And we have been drinking water right there out of the mine, and it hasn't killed us yet. So I don't think there's too much to worry about, Pete and Duane.

But I want to make it very clear that I am here as a County Commissioner, and this may or may not be the feelings of the Board or the position of the County Commissioners. But it's always fun to stand up and talk in front of the members of the BLM and some of the members of the Sierra Club.

Glen, it's been quite a while since I've been with you, but I would like to welcome you to Smoky Valley anytime and present our issue to you. The president of the Sierra Club about a year ago met me in this building and asked me if I would like to come and talk to the Sierra Club and tell them about Nye County's position, and I said I'd love to. And I'm still waiting for the Sierra Club to set the date and time. And I'd be glad to come and speak to you about it, Nye County's position.

Transcript 17 Continued

17-26

Nye County fully supports Round Mountain Gold in this mine expansion. I'm going to tell you that there's never been anybody nicer to work with than Chet, Pete, Duane, and all of the 600, 700 people that work there at that mine. I can't say enough good things about Round Mountain Gold.

They are one of the largest taxpayers in Nye County, and we appreciate that because without Round Mountain Gold, I can tell you Round Mountain would be bankrupt today. I can't tell you how good a neighbor they are because there's not words good enough to describe it.

First of all, how many of you got a neighbor that builds a day care and takes kids that don't even work at that mine? How many of you people have a neighbor that will build a clinic, and I mean that clinic's open to everybody, and I don't care if your a Sierra Club member and you're up South Twin and a rattlesnake bites you, I know that clinic will treat you.

I can remember when we were little kids, Larry, when we had to go to Reno or Fallon to buy groceries. Now the company has a store there that we go in -- and we don't even work at the mine -- and we buy groceries there just the same as anybody else that works at that mine. They do have, like Pete said, they have built the loneliest golf course in America. We have people from all over the county that play golf there. It's just not for the mine employees.

Response to Transcript 17

17-26 Comment noted.

Transcript 17 Continued

But I think the best thing that they've done for our county and for our community in Smoky Valley, is they built a school for us. They turned the keys over to the school district, and those kids come first in our community. And anything those kids want, that mine's always behind them 100 percent. I think they've got the finest subdivision in Nye County, and I'm very proud of the Hadley Subdivision -- And we don't call it the town of Hadley. It's the Hadley Subdivision of the town of Round Mountain.

I want to make it very clear that the Hadley Subdivision does not get water out of the Round Mountain town water supply. They have their own water supply, it's clear across the valley, and that water, I've drank it every since those wells were drilled, and I'm still drinking it. And maybe that's why my hair's falling out, but I don't think so.

As far as the springs go, Marjorie, in Jefferson Canyon, I do have a vested water right in that canyon. I use that water down in my meadow. My cows have been drinking it for years and years, and none of them have ever died yet from anything that ever come out of that creek. That water does go into the town water supply, and all of us kids drank it for years and years, and we haven't died yet. So I don't think there's anything.

I know that the State of Nevada has tested that water on a regular basis, and I think it's every month that

Transcript 17 Continued

that water has to be tested. And so far nothing's ever showed up. And if it does, we will address the problem then.

But Nye County is very concerned about the health and safety of the citizens of our county. And we watch what goes on up there too.

I've got an irrigation well. It's just a few miles to the north of that. In between my irrigation well and the mine is another irrigation well, and when that well comes on, my well goes down. So I know the flow of my water is coming from that mine. And we have had our water tested, and the water in our well is purer than the distilled water that you can buy in the store anywhere.

So with that I'm going to tell you that the action that's been taken by the BLM Management right now is the reason that Nye County has been taken to court by the United States Government.

First of all, in 1992, Nye County followed the recommendation that was happening in Catron County, New Mexico. They were bankrupt because they lost mining, they lost timber, and they were losing their grazing rights. And Catron County stood up and said, Would you, please, federal agencies, follow federal regulations and federal law so we can all work together. That's all that happened in Catron County.

And Nye County said, "We realize what they're

Transcript 17 Continued

doing is on the right track. We're going to follow suit. We recognize federal law and federal regulations only apply to federal property and federal jurisdiction." So right here we ask in this letter -- and I've got a copy of it right here -- We sent it out to both agencies and asked to be involved in all land-use planning decisions, especially mining and grazing issues. And that was in 1992.

17-27

We were totally ignored by both agencies. And right here in this issue here, where Nye County was right down here, and I think in the first room in 1993, I told Chris, Nye County wants to be involved. And you saw the participants in this program right up there on the screen: the BLM, the mine and the environmental group. But Nye County's name was not there. And we have, according to the Code of Federal Regulations, we have the right to be there. And were denied that right.

So what I would like to stress is that we have heard a lot lately in the newspapers and the media about how Nye County has been out here violating laws and the regulations. I'm going to tell you, if Nye County or Dick Carver violated one law, I would be in the Federal Pen today.

We did not violate the law, and even in the lawsuit, it's brought to Nye County by the Federal Government, it states in the Complaint that the United States has no remedy at law to stop Nye County in any future action.

Response to Transcript 17

17-27 The BLM, Round Mountain Gold Corporation, and Riverside Technology, inc. comprise the core team that is working together to complete this EIS. Had Nye County acted as a cooperating agency on this project per 40 Code of Federal Regulations 1501.6, its name would have been presented on the slide to which Mr. Carver refers. Nye County was offered numerous opportunities over and above normal public involvement procedures to participate in the scoping, planning, and review of this EIS. These opportunities are detailed in the response to comment 08-01.

Transcript 17 Continued

17-28

And yet the Bureau of Land Management, right here, is violating their own regulations in not allowing Nye County to participate at the table. And I'm not talking about at the public table like this meeting tonight. We have a place at the table from the day one to its finality.

17-29

The concerns that we have is, there's two issues that are being discussed here that have no business to be discussed. One is pit quality water, the other one is the leach pad dumps. Both of those are issues that involve the state, not the Federal Government. And I had a person last night ask me, "Dick, what would Nye County's role be if you were sitting at that table?" The issue is not what our role would be. The issue is we have a right to be there, and that's what we're complaining about.

But I thought about it last night and I'll tell you what Nye County's role would have been sitting at that table. What we would have been doing is we would have been making damn sure that these people that participate in here follow the regulations. And they would not be addressing pit water, and they would not be addressing leach pad dumps because that does not have anything to do with the expansion of this mine.

I want to just say that I'm not blaming anybody for it, but it's not going to happen again. We realize that this is just the beginning. I know now that because Round

Response to Transcript 17

17-28 Please see the response to comment 08-01.

17-29 Please see the response to comment 08-01. While the State of Nevada has primacy and responsibility for ground water, the BLM is, nevertheless, responsible under 43 Code of Federal Regulations 3809 for preventing "unnecessary and undue" degradation of the public lands. In addition, the BLM has broad authority under the National Environmental Policy Act to analyze the direct, indirect, and cumulative impacts of all major actions that affect and occur on BLM-administered public land.

Mountain Gold was a good neighbor and said, "We'll involve these other issues." That now the bureaucrats are out there saying to the next mines that are doing these, "You have to do it because we had Round Mountain doing it."

That's our concern. We have got to back these bureaucrats down. We want to make damn sure that mining is going to continue forever in Nye County; that ranching's going to continue forever in Nye County; that the recreation on the public lands is going to continue forever.

And Pete and Duane, Nye County's here to help you in any way we can, and Chris, we'll help you in any way we can, if you would, please, drop us a postcard or phone call because we want to be involved.

Ladies and gentlemen, I'm willing to give my life to make sure that in 100 years from now we still have mining in Nevada. And there is a quite a few of us in Nye County that feel the same way. But we cannot do it if we're not included.

I know we have got an individual here that's from the university with the press.

Bruce Babbitt used to work for Nye County, when he bombed out of the presidential primary, before he went to work -- Or was the Secretary of the Interior. And he taught us quite a few things. One of the things he taught us is don't worry about what the press writes about you, just make

Transcript 17 Continued

sure they spell your name right. And my name's spelled C-a-r-v-e-r, if you can spell it right. So I'm going to close her down.

Chris, maybe I'll say something. After the lawsuit, you know, Nye County may be looking for some good help.

MR. STUBBS: No comment.

Thank you, Commissioner Carver. We had a similar discussion last night. Your comments are appreciated, and we'll look at them in the Final EIS.

A couple points I'd like to address, as I did last night. We as an agency care very much about coordination between Nye County and the BLM. We want Nye County to be involved, and it has always been our intent throughout this EIS process to involve Nye County, including holding a meeting in your chambers or a session in one of your regularly scheduled County Commissioner's meetings.

It's a concern to me that you feel the coordination has been inadequate. There are still opportunities for us to put our heads together, and I think that we should talk outside the purview of this meeting to figure out what we can do.

Also in terms of the leach offload piles and the pit water quality, those issues, when we did our internal scoping on this project in 1993, had been determined they'd

never been looked at before, never been revealed to the public. That's why they were dovetailed into this analysis.

Do I have any other remarks from the room?

Okay. It's been a very good discussion tonight. I appreciate everybody coming down. If you didn't sign-in on your way in, it's our way of keeping you on our mailing list or making sure you're on our mailing list. But if you didn't sign-in, if you could please sign-in on your way out.

Thanks for your participation. And I hope everybody drives safely tonight. Good evening.

(At 8:25 p.m., the meeting was concluded.)

Transcript 17 Continued

STATE OF NEVADA,)
) ss.
COUNTY OF WASHOE)

I, CINDY LEE BROWN, Certified Court Reporter and a notary public in and for the County of Washoe, State of Nevada, do hereby certify:

That I was present at the Public Comment Meeting of the BUREAU OF LAND MANAGEMENT on Wednesday, October 18, 1995, and thereafter took stenotype notes of the proceedings, and thereafter transcribed the same into typewriting as herein appears:

That the foregoing transcript is a full, true and correct transcription of my stenotype notes of said proceedings.

Dated at Reno, Nevada, this 27th day of October 1995.

CINDY LEE BROWN, CCR #486

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